

# CPC COOPERATIVE PATENT CLASSIFICATION

## B PERFORMING OPERATIONS; TRANSPORTING

(NOTES omitted)

### SEPARATING; MIXING

**B01 PHYSICAL OR CHEMICAL PROCESSES OR APPARATUS IN GENERAL** (furnaces, kilns, ovens, retorts in general [F27](#))

### **B01J CHEMICAL OR PHYSICAL PROCESSES, e.g. CATALYSIS OR COLLOID CHEMISTRY; THEIR RELEVANT APPARATUS**

#### NOTES

- In this subclass, the following terms or expressions are used with the meanings indicated :
  - "solid particles" includes such particles whether catalysts, reactants or inert in solid, semi-solid or pasty state;
  - "fluidised particles" means finely divided solid particles lifted and agitated by a stream of fluid;
  - "fluidised bed-technique" means fluid-solid contacting technique in which finely divided particles are lifted and agitated by a rising stream of fluid, said stream having such a speed as to form a lower dense phase (the "bed") and an upper dilute fluidised phase of "fluidised particles";
  - "processes conducted in the presence of solid particles" does not include processes wherein the only solid particles present are formed during the reaction.
- In this subclass, tradenames that are often found in scientific and patent literature have been used in order to define precisely the scope of the groups

#### WARNING

The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

[B01J 37/025](#)

covered by

[B01J 37/02](#)

[B01D 15/04](#)

covered by

[B01J 39/00-B01J 49/90](#)

<b>2/00</b>	<b>Processes or devices for granulating materials {, e.g. fertilisers} in general; Rendering particulate materials free flowing in general, e.g. making them hydrophobic</b>				material at the moment of its suspension in the gas
		2/18			. using a vibrating apparatus
2/003	. {followed by coating of the granules (to prevent the granules sticking together <a href="#">B01J 2/30</a> )}	2/20			. by expressing the material, e.g. through sieves and fragmenting the extruded length
2/006	. {Coating of the granules without description of the process or the device by which the granules are obtained (to prevent the granules sticking together <a href="#">B01J 2/30</a> )}	2/22			. by pressing in moulds or between rollers
		2/24			. Obtaining flakes by scraping a solid layer from a surface
2/02	. by dividing the liquid material into drops, e.g. by spraying, and solidifying the drops	2/26			. on endless conveyor belts
2/04	. . in a gaseous medium {(if combined with suspending the material in a gas, e.g. fluidised beds <a href="#">B01J 2/16</a> )}	2/28			. using special binding agents
		2/30			. using agents to prevent the granules sticking together; Rendering particulate materials free flowing in general, e.g. making them hydrophobic
2/06	. . in a liquid medium	<b>3/00</b>			<b>Processes of utilising sub-atmospheric or super-atmospheric pressure to effect chemical or physical change of matter; Apparatus therefor (pressure vessels for containing or storing compressed, liquefied or solidified gases <a href="#">F17C</a>)</b>
2/08	. . . Gelation of a colloidal solution				
2/10	. in stationary drums or troughs, provided with kneading or mixing appliances				
2/12	. in rotating drums	3/002			. {Component parts of these vessels not mentioned in <a href="#">B01J 3/004</a> , <a href="#">B01J 3/006</a> , <a href="#">B01J 3/02</a> - <a href="#">B01J 3/08</a> ; Measures taken in conjunction with the process to be carried out, e.g. safety measures}
2/14	. in rotating dishes or pans				
2/16	. by suspending the powder material in a gas, e.g. in fluidised beds or as a falling curtain	3/004			. {Sight-glasses therefor (see also <a href="#">G02B</a> )}
		3/006			. {Processes utilising sub-atmospheric pressure; Apparatus therefor}
		3/008			. {Processes carried out under supercritical conditions}
		3/02			. Feed or outlet devices therefor

#### NOTE

For classification in [B01J 2/16](#), the fact that during the process the material is suspended in a gas prevails over the aggregation state of the

- 3/03 . Pressure vessels, or vacuum vessels, having closure members or seals specially adapted therefor
- 3/04 . Pressure vessels, e.g. autoclaves
- 3/042 . . {in the form of a tube}
- 3/044 . . {in the form of a loop}
- 3/046 . . {Pressure-balanced vessels}
- 3/048 . . {Multiwall, strip or filament wound vessels (for pressurised gas vessels [F17C 1/06](#); for making them [B29](#))}
- 3/06 . Processes using ultra high pressure, e.g. for the formation of diamonds; Apparatus therefor, e.g. moulds or dies ([B01J 3/04](#) takes precedence)
- 3/062 . . {characterised by the composition of the materials to be processed}
- 3/065 . . {Presses for the formation of diamonds or boronitrides}
- 3/067 . . . {Presses using a plurality of pressing members working in different directions}
- 3/08 . . Application of shock waves for chemical reactions or for modifying the crystal structure of substances {, e.g. reactions carried out by explosions or in a combustion engine-type reactor}
- 4/00 Feed {or outlet} devices; Feed or outlet control devices (feed or outlet devices for pressure vessels [B01J 3/02](#) {; feeding of particles into and evacuation of particles out of the reactor [B01J 8/0015](#))}**
- 4/001 . {Feed or outlet devices as such, e.g. feeding tubes}
- 4/002 . . {Nozzle-type elements (nozzle-type reactors [B01J 19/26](#))}
- 4/004 . . {Sparger-type elements}
- 4/005 . . {provided with baffles}
- 4/007 . . {provided with moving parts}
- 4/008 . {Feed or outlet control devices}
- 4/02 . for feeding measured {, i.e. prescribed} quantities of reagents
- 4/04 . using osmotic pressure {using membranes, porous plates}
- 6/00 {Heat treatments such as} Calcining; Fusing {Pyrolysis (furnaces [F27D](#))}**
- 6/001 . {Calcining}
- 6/002 . . {using rotating drums}
- 6/004 . . {using hot gas streams in which the material is moved}
- 6/005 . {Fusing}
- 6/007 . . {in crucibles}
- 6/008 . {Pyrolysis reactions (of hydrocarbons [C10G 9/00](#))}
- 7/00 Apparatus for generating gases (production of inert gas mixtures [B01J 19/14](#); for generating specific gases, see the relevant subclasses, e.g. [C01B](#), [C10J](#) {; in "air bags" on vehicles [B60R 21/26](#); for starter gas [F02C 7/26](#); blasting cartridges for producing gas under pressure [F42B 3/04](#))}**
- 7/02 . by wet methods
- 8/00 Chemical or physical processes in general, conducted in the presence of fluids and solid particles; Apparatus for such processes**
- 8/0005 . {Catalytic processes under superatmospheric pressure (non-catalytic processes [B01J 3/00](#))}
- 8/001 . {Controlling catalytic processes ([B01J 8/1809](#) takes precedence)}
- 8/0015 . {Feeding of the particles in the reactor; Evacuation of the particles out of the reactor}
- 8/002 . . {with a moving instrument}
- 8/0025 . . {by an ascending fluid}
- 8/003 . . {in a downward flow}
- 8/0035 . . {Periodical feeding or evacuation}
- 8/004 . . {by means of a nozzle}
- 8/0045 . . {by means of a rotary device in the flow channel}
- 8/005 . {Separating solid material from the gas/liquid stream (separation processes per se [B01D](#))}
- 8/0055 . . {using cyclones}
- 8/006 . . {by filtration}
- 8/0065 . . {by impingement against stationary members}
- 8/007 . . {by sedimentation}
- 8/0075 . . {by electrostatic precipitation}
- 8/008 . {Details of the reactor or of the particulate material; Processes to increase or to retard the rate of reaction ([B01J 8/0285](#), [B01J 8/067](#), [B01J 8/087](#), [B01J 8/1836](#) take precedence)}
- 8/0085 . . {promoting uninterrupted fluid flow, e.g. by filtering out particles in front of the catalyst layer}
- 8/009 . . {Membranes, e.g. feeding or removing reactants or products to or from the catalyst bed through a membrane}
- 8/0095 . {in which two different types of particles react with each other}
- 8/02 . with stationary particles, e.g. in fixed beds
- 8/0207 . . {the fluid flow within the bed being predominantly horizontal}
- 8/0214 . . . {in a cylindrical annular shaped bed}
- 8/0221 . . . {in a cylindrical shaped bed ([B01J 8/0214](#) takes precedence)}
- 8/0228 . . . {in a conically shaped bed}
- 8/0235 . . . {in a spiral shaped bed}
- 8/0242 . . {the fluid flow within the bed being predominantly vertical}
- 8/025 . . . {in a cylindrical shaped bed}
- 8/0257 . . . {in a cylindrical annular shaped bed}
- 8/0264 . . . {in a conically shaped bed}
- 8/0271 . . . {in a spiral shaped bed}
- 8/0278 . . {Feeding reactive fluids (for solid material [B01J 8/0015](#))}
- 8/0285 . . {Heating or cooling the reactor (for tubular reactors in furnaces [B01J 8/062](#))}
- 8/0292 . . {with stationary packing material in the bed, e.g. bricks, wire rings, baffles}
- 8/04 . . the fluid passing successively through two or more beds
- 8/0403 . . . {the fluid flow within the beds being predominantly horizontal}
- 8/0407 . . . . {through two or more cylindrical annular shaped beds}
- 8/0411 . . . . . {the beds being concentric}
- 8/0415 . . . . . {the beds being superimposed one above the other ([B01J 8/0434](#) takes precedence)}
- 8/0419 . . . . . {the beds being placed in separate reactors}
- 8/0423 . . . . . {through two or more otherwise shaped beds}
- 8/0426 . . . . . {the beds being superimposed one above the other}

- 8/043 . . . . . {in combination with one cylindrical annular shaped bed}
- 8/0434 . . . . . {in combination with two or more cylindrical annular shaped beds}
- 8/0438 . . . . . {the beds being placed next to each other}
- 8/0442 . . . . . {the beds being placed in separate reactors}
- 8/0446 . . . . . {the flow within the beds being predominantly vertical}
- 8/0449 . . . . . {in two or more cylindrical beds}
- 8/0453 . . . . . {the beds being superimposed one above the other}
- 8/0457 . . . . . {the beds being placed in separate reactors}
- 8/0461 . . . . . {in two or more cylindrical annular shaped beds}
- 8/0465 . . . . . {the beds being concentric}
- 8/0469 . . . . . {the beds being superimposed one above the other}
- 8/0473 . . . . . {the beds being placed in separate reactors}
- 8/0476 . . . . . {in two or more otherwise shaped beds}
- 8/048 . . . . . {the beds being superimposed one above the other}
- 8/0484 . . . . . {the beds being placed next to each other}
- 8/0488 . . . . . {the beds being placed in separate reactors}
- 8/0492 . . . . . {Feeding reactive fluids (for solid material, [see B01J 8/0015](#))}
- 8/0496 . . . . . {Heating or cooling the reactor}
- 8/06 . . . . . in tube reactors; the solid particles being arranged in tubes
- 8/062 . . . . . {being installed in a furnace}
- 8/065 . . . . . {Feeding reactive fluids}
- 8/067 . . . . . {Heating or cooling the reactor ([B01J 8/062 takes precedence](#))}
- 8/08 . . . . . with moving particles ([with fluidised particles B01J 8/18](#))
- 8/082 . . . . . {Controlling processes}
- 8/085 . . . . . {Feeding reactive fluids (for solid material, [see B01J 8/0015](#))}
- 8/087 . . . . . {Heating or cooling the reactor}
- 8/10 . . . . . moved by stirrers or by rotary drums or rotary receptacles {or endless belts}
- 8/12 . . . . . moved by gravity in a downward flow
- 8/125 . . . . . {with multiple sections one above the other separated by distribution aids, e.g. reaction and regeneration sections}
- 8/14 . . . . . moving in free vortex flow apparatus
- 8/16 . . . . . with particles being subjected to vibrations or pulsations ([B01J 8/40 takes precedence](#))
- 8/18 . . . . . with fluidised particles {(combustion apparatus with fluidised bed in general [F23C 10/00](#); furnaces with fluidised bed [F27B 15/00](#))}
- 8/1809 . . . . . {Controlling processes}
- 8/1818 . . . . . {Feeding of the fluidising gas ([B01J 8/44 takes precedence](#))}
- 8/1827 . . . . . {the fluidising gas being a reactant}
- 8/1836 . . . . . {Heating and cooling the reactor ([B01J 8/42 takes precedence](#))}
- 8/1845 . . . . . {with particles moving upwards while fluidised}
- 8/1854 . . . . . {followed by a downward movement inside the reactor to form a loop}
- 8/1863 . . . . . {followed by a downward movement outside the reactor and subsequently re-entering it}
- 8/1872 . . . . . {Details of the fluidised bed reactor ([B01J 8/1836 takes precedence](#))}
- 8/1881 . . . . . {with particles moving downwards while fluidised}
- 8/189 . . . . . {moving downwards in a zig-zag manner}
- 8/20 . . . . . with liquid as a fluidising medium
- 8/22 . . . . . gas being introduced into the liquid
- 8/222 . . . . . {in the presence of a rotating device only}
- 8/224 . . . . . {the particles being subject to a circulatory movement ([B01J 8/222 takes precedence](#))}
- 8/226 . . . . . {internally, i.e. the particles rotate within the vessel}
- 8/228 . . . . . {externally, i.e. the particles leaving the vessel and subsequently re-entering it}
- 8/24 . . . . . according to "fluidised-bed" technique ([B01J 8/20 takes precedence](#))
- 8/245 . . . . . {Spouted-bed technique}
- 8/26 . . . . . with two or more fluidised beds, e.g. reactor and regeneration installations
- 8/28 . . . . . the one above the other
- 8/30 . . . . . the edge of a lower bed projecting beyond the edge of the superjacent bed
- 8/32 . . . . . with introduction into the fluidised bed of more than one kind of moving particles
- 8/34 . . . . . with stationary packing material in the fluidised bed, e.g. bricks, wire rings, baffles
- 8/36 . . . . . with fluidised bed through which there is an essentially horizontal flow of particles
- 8/38 . . . . . with fluidised bed containing a rotatable device or being subject to rotation {or to a circulatory movement, i.e. leaving a vessel and subsequently re-entering it}
- 8/382 . . . . . {with a rotatable device only}
- 8/384 . . . . . {being subject to a circulatory movement only ([B01J 8/382 takes precedence](#))}
- 8/386 . . . . . {internally, i.e. the particles rotate within the vessel}
- 8/388 . . . . . {externally, i.e. the particles leaving the vessel and subsequently re-entering it}
- 8/40 . . . . . with fluidised bed subjected to vibrations or pulsations
- 8/42 . . . . . with fluidised bed subjected to electric current or to radiations {this sub-group includes the fluidised bed subjected to electric or magnetic fields}
- 8/44 . . . . . Fluidisation grids
- 8/46 . . . . . for treatment of endless filamentary, band or sheet material
- 10/00** . . . . . **Chemical processes in general for reacting liquid with gaseous media other than in the presence of solid particles, or apparatus specially adapted therefor ([B01J 19/08 takes precedence](#); separation, e.g. distillation, also combined with chemical reactions [B01D](#), {e.g. [B01D 3/009](#)})**
- 10/002 . . . . . {carried out in foam, aerosol or bubbles}
- 10/005 . . . . . {carried out at high temperatures in the presence of a molten material}
- 10/007 . . . . . {in the presence of catalytically active bodies, e.g. porous plates}
- 10/02 . . . . . of the thin-film type

- 12/00 Chemical processes in general for reacting gaseous media with gaseous media; Apparatus specially adapted therefor** ([B01J 3/08](#), [B01J 8/00](#), [B01J 19/08](#) take precedence)
- 12/002 . {carried out in the plasma state (generating or handling plasma [H05H 1/00](#))}
- 12/005 . {carried out at high temperatures, e.g. by pyrolysis}
- 12/007 . {in the presence of catalytically active bodies, e.g. porous plates}
- 12/02 . for obtaining at least one reaction product which, at normal temperature, is in the solid state
- 13/00 Colloid chemistry, e.g. the production of colloidal materials or their solutions, not otherwise provided for; Making microcapsules or microballoons**
- 13/0004 . {Preparation of sols (by physical processes [B01J 13/0086](#), aerosols [B01J 13/0095](#))}
- 13/0008 . . {Sols of inorganic materials in water}
- 13/0013 . . . {from a precipitate}
- 13/0017 . . . {by extraction of ions from aqueous solutions}
- 13/0021 . . {containing a solid organic phase}
- 13/0026 . . {containing a liquid organic phase}
- 13/003 . . . {Preparation from aqueous sols}
- 13/0034 . . {Additives, e.g. in view of promoting stabilisation or peptisation}
- 13/0039 . . {Post treatment}
- 13/0043 . . {containing elemental metal (for medical or diagnostical purposes [A61K](#), [G01N](#))}
- 13/0047 . . {containing a metal oxide}
- 13/0052 . {Preparation of gels}
- 13/0056 . . {containing inorganic material and water}
- 13/006 . . . {by precipitation, coagulation, hydrolyse coacervation}
- 13/0065 . . {containing an organic phase}
- 13/0069 . . {Post treatment}
- 13/0073 . {Preparation of non-Newtonian sols, e.g. thixotropic solutions}
- 13/0078 . . {containing inorganic material and water}
- 13/0082 . . {containing an organic phase}
- 13/0086 . {Preparation of sols by physical processes (colloid mills [B02C](#))}
- 13/0091 . {Preparation of aerogels, e.g. xerogels}
- 13/0095 . {Preparation of aerosols}
- 13/02 . Making microcapsules or microballoons {(for medical preparations [A61K 9/50](#))}
- 13/025 . . {Applications of microcapsules not provided for in other subclasses}
- 13/04 . . by physical processes, e.g. drying, spraying
- 13/043 . . . {Drying and spraying}
- 13/046 . . . {combined with gelification or coagulation}
- 13/06 . . by phase separation
- 13/08 . . . Simple coacervation, i.e. addition of highly hydrophilic material {(combined with spraying [B01J 13/043](#); combined with mechanical division [B01J 13/04](#))}
- 13/10 . . . Complex coacervation, i.e. interaction of oppositely charged particles
- 13/12 . . . removing solvent from the wall-forming material solution
- 13/125 . . . . {by evaporation of the solvent (apparatus therefor [B01J 13/043](#))}
- 13/14 . . . Polymerisation; cross-linking
- 13/16 . . . . Interfacial polymerisation
- 13/18 . . . . In situ polymerisation with all reactants being present in the same phase
- 13/185 . . . . . {in an organic phase}
- 13/20 . . After-treatment of capsule walls, e.g. hardening
- 13/203 . . . {Exchange of core-forming material by diffusion through the capsule wall}
- 13/206 . . . {Hardening; drying}
- 13/22 . . . Coating
- 14/00 Chemical processes in general for reacting liquids with liquids; Apparatus specially adapted therefor** ([B01J 8/00](#), [B01J 19/08](#) take precedence)
- 14/005 . {in the presence of catalytically active bodies, e.g. porous plates}
- 15/00 Chemical processes in general for reacting gaseous media with non-particulate solids, e.g. sheet material; Apparatus specially adapted therefor** ([B01J 19/08](#) takes precedence)
- 15/005 . {in the presence of catalytically active bodies, e.g. porous plates}
- 16/00 Chemical processes in general for reacting liquids with non-particulate solids, e.g. sheet material; Apparatus specially adapted therefor** ([B01J 19/08](#) takes precedence)
- 16/005 . {in the presence of catalytically active bodies, e.g. porous plates}
- 19/00 Chemical, physical or physico-chemical processes in general; Their relevant apparatus**
- 19/0006 . {Controlling or regulating processes (controlling or regulating in general [G05](#))}
- 19/0013 . . {Controlling the temperature of the process}
- 19/002 . . {Avoiding undesirable reactions or side-effects, e.g. avoiding explosions, or improving the yield by suppressing side-reactions}
- 19/0026 . . . {Avoiding carbon deposits (inhibiting incrustation in general, [C23F 14/00](#), [C23F 15/00](#))}
- 19/0033 . . {Optimisation processes, i.e. processes with adaptive control systems (adaptive control systems *per se* [G05B 13/00](#))}
- 19/004 . . {Multifunctional apparatus for automatic manufacturing of various chemical products (sequential reactions [B01J 19/0046](#))}
- 19/0046 . {Sequential or parallel reactions, e.g. for the synthesis of polypeptides or polynucleotides; Apparatus and devices for combinatorial chemistry or for making molecular arrays (synthesis methods *per se* [C40B 50/00](#))}
- 19/0053 . {Details of the reactor}
- 19/006 . . {Baffles}
- 19/0066 . . {Stirrers (mixing *per se* [B01F](#))}
- 19/0073 . . {Sealings (sealings for pressure vessels *per se* [F16J 15/00](#))}
- 19/008 . {Processes for carrying out reactions under cavitation conditions}
- 19/0086 . {Processes carried out with a view to control or to change the pH-value; Applications of buffer salts; Neutralisation reactions}
- 19/0093 . {Microreactors, e.g. miniaturised or microfabricated reactors (laboratory containers with capillary fluid transport in microfabricated channels or chambers [B01L 3/5027](#))}



- 19/02 . Apparatus characterised by being constructed of material selected for its chemically-resistant properties
- 19/06 . Solidifying liquids ([making microcapsules B01J 13/02](#))
- 19/08 . Processes employing the direct application of electric or wave energy, or particle radiation; Apparatus therefor ([application of shock waves B01J 3/08](#))
- 19/081 . . {employing particle radiation or gamma-radiation}
- 19/082 . . . {Gamma-radiation only}
- 19/084 . . . {Neutron beams only}
- 19/085 . . . {Electron beams only}
- 19/087 . . {employing electric or magnetic energy}
- 19/088 . . . {giving rise to electric discharges (for heating purposes [H05B 7/00](#); for the production of ozone [C01B 13/11](#), [H01T 19/00](#))}
- 19/10 . . employing sonic or ultrasonic vibrations
- 19/12 . . employing electromagnetic waves
- 19/121 . . . {Coherent waves, e.g. laser beams ([lasers per se H01S 3/00](#))}
- 19/122 . . . {Incoherent waves ([gamma-radiation B01J 19/082](#))}
- 19/123 . . . . {Ultra-violet light}
- 19/124 . . . . . {generated by microwave irradiation}
- 19/125 . . . . {X-rays}
- 19/126 . . . . {Microwaves}
- 19/127 . . . . {Sunlight; Visible light}
- 19/128 . . . . {Infra-red light}
- 19/129 . . . . {Radiofrequency}
- 19/14 . Production of inert gas mixtures; Use of inert gases in general
- 19/16 . Preventing evaporation or oxidation of non-metallic liquids by applying a floating layer, e.g. of microballoons ([in storage tanks B65D 90/42](#))
- 19/18 . Stationary reactors having moving elements inside ([B01J 19/08](#), [B01J 19/26 take precedence](#))
- 19/1806 . . {resulting in a turbulent flow of the reactants, such as in centrifugal-type reactors, or having a high Reynolds-number}
- 19/1812 . . {Tubular reactors}
- 19/1818 . . . {in series}
- 19/1825 . . . {in parallel}
- 19/1831 . . . {spirally, concentrically or zigzag wound}
- 19/1837 . . . {Loop-type reactors}
- 19/1843 . . . {Concentric tube}
- 19/185 . . {of the pulsating type}
- 19/1856 . . {placed in parallel}
- 19/1862 . . {placed in series}
- 19/1868 . . {resulting in a loop-type movement}
- 19/1875 . . . {internally, i.e. the mixture circulating inside the vessel such that the upwards stream is separated physically from the downwards stream(s)}
- 19/1881 . . . {externally, i.e. the mixture leaving the vessel and subsequently re-entering it}
- 19/1887 . . {forming a thin film}
- 19/1893 . . {Membrane reactors ([membranes B01D 71/00](#); [catalytic membranes B01J 35/065](#))}
- 19/20 . . in the form of helices, e.g. screw reactors
- 19/22 . . in the form of endless belts
- 19/24 . Stationary reactors without moving elements inside ([B01J 19/08](#), [B01J 19/26 take precedence](#); with [stationary particles B01J 8/02](#))
- 19/2405 . . {provoking a turbulent flow of the reactants, such as in cyclones, or having a high Reynolds-number}
- 19/241 . . . {of the pulsating type}
- 19/2415 . . . {Tubular reactors}
- 19/242 . . . . {in series}
- 19/2425 . . . . {in parallel}
- 19/243 . . . . {spirally, concentrically or zigzag wound}
- 19/2435 . . . . {Loop-type reactors}
- 19/244 . . . . {Concentric tubes}
- 19/2445 . . . {placed in parallel}
- 19/245 . . . {placed in series}
- 19/2455 . . . {provoking a loop type movement of the reactants ([tubular loop-type reactors B01J 19/2435](#); [loop reactors having moving elements inside B01J 19/1868](#))}
- 19/246 . . . . {internally, i.e. the mixture circulating inside the vessel such that the upward stream is separated physically from the downward stream(s)}
- 19/2465 . . . . {externally, i.e. the mixture leaving the vessel and subsequently re-entering it}
- 19/247 . . . {Suited for forming thin films}
- 19/2475 . . . {Membrane reactors}
- 19/248 . . . {Reactors comprising multiple separated flow channels}
- 19/2485 . . . . {Monolithic reactors}
- 19/249 . . . . {Plate-type reactors}
- 19/2495 . . . . {Net-type reactors}
- 19/26 . Nozzle-type reactors, i.e. the distribution of the initial reactants within the reactor is effected by their introduction or injection through nozzles
- 19/28 . Moving reactors, e.g. rotary drums ([B01J 19/08 takes precedence](#))
- 19/285 . . {Shaking or vibrating reactors; reactions under the influence of low-frequency vibrations or pulsations ([for sonic and ultrasonic vibrations B01J 19/10](#))}
- 19/30 . Loose or shaped packing elements, e.g. Raschig rings or Berl saddles, for pouring into the apparatus for mass or heat transfer
- 19/305 . . {Supporting elements therefor, e.g. grids, perforated plates}
- 19/32 . Packing elements in the form of grids or built-up elements for forming a unit or module inside the apparatus for mass or heat transfer
- 19/325 . . {Attachment devices therefor, e.g. hooks, consoles, brackets}

**Solid sorbent compositions or filter aid compositions; Sorbents for chromatography; Catalysts**

**NOTES**

- In groups [B01J 20/00](#) - [B01J 31/00](#), metal salts having an anion composed of metal and oxygen only, e.g. molybdates, are considered as chemically bound mixtures of the component metal oxides.
- Attention is drawn to the definitions of groups of chemical elements following the title of section [C](#).
- In group [B01J 20/00](#) and in each set of groups [B01J 21/00](#) - [B01J 31/00](#) and [B01J 32/00](#) - [B01J 38/00](#), the last place priority rule is applied, i.e. at each hierarchical level, in the

- absence of an indication to the contrary, classification is made in the last appropriate place.
4. Pure compounds or elements, or their recovery from solid sorbent compositions, filter aid compositions, or catalysts, are classified in the appropriate subclass for chemical compounds or elements. However, when it is explicitly stated that the pure compound or element, in a particular form, is especially useful as a solid sorbent, filter aid, or catalyst, it is further classified in group [B01J 20/00](#) or [B01J 35/00](#).
5. {In groups [B01J 21/00](#) - [B01J 38/00](#), the following term is used with the meaning indicated:
- "catalyst" covers also a carrier forming part of the catalyst. }
6. {Classification of the:
- carriers;
  - forms or physical properties;
  - preparation or activation;
  - regeneration or reactivation of catalysts according to more than one of main groups [B01J 21/00](#) - [B01J 31/00](#) is made in the following general groups:
    - [B01J 32/00](#) for such carriers;
    - [B01J 35/00](#) for such forms or physical properties;
    - [B01J 37/00](#) for such preparation or activation;
    - [B01J 38/00](#) for such regeneration or reactivation. }
- 20/00 Solid sorbent compositions or filter aid compositions; Sorbents for chromatography; Processes for preparing, regenerating or reactivating thereof**
- 20/02 . comprising inorganic material
- 20/0203 . . {comprising compounds of metals not provided for in [B01J 20/04](#) (oxides or hydroxides thereof [B01J 20/06](#))}
- NOTE**
- Compounds classified in group [B01J 20/0203](#) and subgroups are also classified in [B01J 20/0274](#) according to the type of anion
- 20/0207 . . . {Compounds of Sc, Y or Lanthanides}
- 20/0211 . . . {Compounds of Ti, Zr, Hf}
- 20/0214 . . . {Compounds of V, Nb, Ta}
- 20/0218 . . . {Compounds of Cr, Mo, W}
- 20/0222 . . . {Compounds of Mn, Re}
- 20/0225 . . . {Compounds of Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt}
- 20/0229 . . . . {Compounds of Fe}
- 20/0233 . . . {Compounds of Cu, Ag, Au}
- 20/0237 . . . . {Compounds of Cu}
- 20/024 . . . {Compounds of Zn, Cd, Hg}
- 20/0244 . . . . {Compounds of Zn}
- 20/0248 . . . {Compounds of B, Al, Ga, In, Tl ([B01J 20/08](#) takes precedence)}
- 20/0251 . . . {Compounds of Si, Ge, Sn, Pb ([B01J 20/10](#) takes precedence)}
- 20/0255 . . . . {Compounds of Pb}
- 20/0259 . . . {Compounds of N, P, As, Sb, Bi}
- 20/0262 . . . {Compounds of O, S, Se, Te}
- 20/0266 . . . . {Compounds of S}
- 20/027 . . . {Compounds of F, Cl, Br, I}
- 20/0274 . . . {characterised by the type of anion}
- 20/0277 . . . . {Carbonates of compounds other than those provided for in [B01J 20/043](#)}
- 20/0281 . . . . {Sulfates of compounds other than those provided for in [B01J 20/045](#)}
- 20/0285 . . . . {Sulfides of compounds other than those provided for in [B01J 20/045](#)}
- 20/0288 . . . . {Halides of compounds other than those provided for in [B01J 20/046](#)}
- 20/0292 . . . . {Phosphates of compounds other than those provided for in [B01J 20/048](#)}
- 20/0296 . . . . {Nitrates of compounds other than those provided for in [B01J 20/04](#)}
- 20/04 . . comprising compounds of alkali metals, alkaline earth metals or magnesium
- 20/041 . . . {Oxides or hydroxides}
- 20/043 . . . {Carbonates or bicarbonates, e.g. limestone, dolomite, aragonite}
- 20/045 . . . {containing sulfur, e.g. sulfates, thiosulfates, gypsum}
- 20/046 . . . {containing halogens, e.g. halides}
- 20/048 . . . {containing phosphorus, e.g. phosphates, apatites, hydroxyapatites}
- 20/06 . . comprising oxides or hydroxides of metals not provided for in group [B01J 20/04](#)
- 20/08 . . . comprising aluminium oxide or hydroxide; comprising bauxite
- 20/10 . . comprising silica or silicate
- 20/103 . . . {comprising silica}
- 20/106 . . . . {Perlite}
- 20/12 . . . Naturally occurring clays or bleaching earth
- 20/14 . . . Diatomaceous earth
- 20/16 . . . Alumino-silicates ([B01J 20/12](#) takes precedence)
- 20/165 . . . . {Natural alumino-silicates, e.g. zeolites}
- 20/18 . . . . Synthetic zeolitic molecular sieves
- 20/183 . . . . . {Physical conditioning without chemical treatment, e.g. drying, granulating, coating, irradiation}
- 20/186 . . . . . {Chemical treatments in view of modifying the properties of the sieve, e.g. increasing the stability or the activity, also decreasing the activity}
- 20/20 . . comprising free carbon; comprising carbon obtained by carbonising processes
- 20/205 . . . {Carbon nanostructures, e.g. nanotubes, nanohorns, nanocones, nanoballs (carbon nanotubes per se [C01B 32/15](#))}
- 20/22 . comprising organic material
- 20/223 . . {containing metals, e.g. organo-metallic compounds, coordination complexes}
- 20/226 . . . {Coordination polymers, e.g. metal-organic frameworks [MOF], zeolitic imidazolate frameworks [ZIF] (preparation of metal complexes containing carboxylic acid moieties [C07C 51/418](#); MOF's per se [C07F](#))}
- 20/24 . . Naturally occurring macromolecular compounds, e.g. humic acids or their derivatives
- 20/26 . . Synthetic macromolecular compounds
- 20/261 . . . {obtained by reactions only involving carbon to carbon unsaturated bonds (macromolecular compounds obtained by reactions only involving carbon-to-carbon unsaturated bonds per se [C08F](#))}

- 20/262 . . . {obtained otherwise than by reactions only involving carbon to carbon unsaturated bonds, e.g. obtained by polycondensation (macromolecular compounds obtained otherwise than by reactions only involving unsaturated carbon-to-carbon bonds [per se C08G](#))}
- 20/264 . . . {derived from different types of monomers, e.g. linear or branched copolymers, block copolymers, graft copolymers}
- 20/265 . . . {modified or post-treated polymers (polymer carriers or substrates subjected to further impregnating or coating [B01J 20/3208](#))}
- 20/267 . . . . {Cross-linked polymers}
- 20/268 . . . {Polymers created by use of a template, e.g. molecularly imprinted polymers}
- 20/28 . . . characterised by their form or physical properties
- 20/28002 . . . {characterised by their physical properties}
- 20/28004 . . . {Sorbent size or size distribution, e.g. particle size}
- 20/28007 . . . . {with size in the range 1-100 nanometers, e.g. nanosized particles, nanofibers, nanotubes, nanowires or the like (carbon nanostructures [B01J 20/205](#))}
- 20/28009 . . . {Magnetic properties}
- 20/28011 . . . {Other properties, e.g. density, crush strength}
- 20/28014 . . . {characterised by their form}
- 20/28016 . . . {Particle form}
- 20/28019 . . . . {Spherical, ellipsoidal or cylindrical}
- 20/28021 . . . . {Hollow particles, e.g. hollow spheres, microspheres or cenospheres}
- 20/28023 . . . {Fibres or filaments (fibres or filaments in the form of membranes [B01J 20/28038](#); [B01J 20/28007](#) takes precedence)}
- 20/28026 . . . {Particles within, immobilised, dispersed, entrapped in or on a matrix, e.g. a resin}
- 20/28028 . . . {Particles immobilised within fibres or filaments}
- 20/2803 . . . {Sorbents comprising a binder, e.g. for forming aggregated, agglomerated or granulated products}
- 20/28033 . . . {Membrane, sheet, cloth, pad, lamellar or mat}
- 20/28035 . . . . {with more than one layer, e.g. laminates, separated sheets}
- 20/28038 . . . . {Membranes or mats made from fibers or filaments}
- 20/2804 . . . . {Sheets with a specific shape, e.g. corrugated, folded, pleated, helical}
- 20/28042 . . . {Shaped bodies; Monolithic structures}
- 20/28045 . . . . {Honeycomb or cellular structures; Solid foams or sponges}
- 20/28047 . . . {Gels}
- 20/2805 . . . {Sorbents inside a permeable or porous casing, e.g. inside a container, bag or membrane}
- 20/28052 . . . {Several layers of identical or different sorbents stacked in a housing, e.g. in a column}
- 20/28054 . . {characterised by their surface properties or porosity}
- 20/28057 . . . {Surface area, e.g. B.E.T specific surface area}
- 20/28059 . . . . {being less than 100 m<sup>2</sup>/g}
- 20/28061 . . . . {being in the range 100-500 m<sup>2</sup>/g}
- 20/28064 . . . . {being in the range 500-1000 m<sup>2</sup>/g}
- 20/28066 . . . . {being more than 1000 m<sup>2</sup>/g}
- 20/28069 . . . . {Pore volume, e.g. total pore volume, mesopore volume, micropore volume}
- 20/28071 . . . . {being less than 0.5 ml/g}
- 20/28073 . . . . {being in the range 0.5-1.0 ml/g}
- 20/28076 . . . . {being more than 1.0 ml/g}
- 20/28078 . . . . {Pore diameter}
- 20/2808 . . . . {being less than 2 nm, i.e. micropores or nanopores}
- 20/28083 . . . . {being in the range 2-50 nm, i.e. mesopores}
- 20/28085 . . . . {being more than 50 nm, i.e. macropores}
- 20/28088 . . . {Pore-size distribution}
- 20/2809 . . . . {Monomodal or narrow distribution, uniform pores}
- 20/28092 . . . . {Bimodal, polymodal, different types of pores or different pore size distributions in different parts of the sorbent}
- 20/28095 . . . {Shape or type of pores, voids, channels, ducts}
- 20/28097 . . . . {being coated, filled or plugged with specific compounds}
- 20/281 . . . Sorbents specially adapted for preparative, analytical or investigative chromatography
- NOTE**
- In groups [B01J 20/281](#) - [B01J 20/292](#) it is desirable to add indexing codes for aspects relating to sorbents specially adapted for preparative, analytical or investigative chromatography. The indexing codes are chosen from groups [B01J 2220/80](#) - [B01J 2220/86](#)
- 20/282 . . . Porous sorbents (ion exchange [B01J 39/00](#) - [B01J 41/00](#))
- 20/283 . . . based on silica
- 20/284 . . . based on alumina
- 20/285 . . . based on polymers
- 20/286 . . . Phases chemically bonded to a substrate, e.g. to silica or to polymers
- 20/287 . . . Non-polar phases; Reversed phases
- 20/288 . . . Polar phases
- 20/289 . . . bonded via a spacer
- 20/29 . . . Chiral phases
- 20/291 . . . Gel sorbents
- 20/292 . . . Liquid sorbents
- 20/30 . . . Processes for preparing, regenerating, or reactivating
- 20/3007 . . . {Moulding, shaping or extruding}
- 20/3014 . . . {Kneading}
- 20/3021 . . . {Milling, crushing or grinding}
- 20/3028 . . . {Granulating, agglomerating or aggregating}
- 20/3035 . . . {Compressing}
- 20/3042 . . . {Use of binding agents; addition of materials ameliorating the mechanical properties of the produced sorbent}
- 20/305 . . . {Addition of material, later completely removed, e.g. as result of heat treatment, leaching or washing, e.g. for forming pores}
- 20/3057 . . . . {Use of a templating or imprinting material (molecularly imprinted polymers [B01J 20/268](#)); filling pores of a substrate or matrix followed by the removal of the substrate or matrix}
- 20/3064 . . . . {Addition of pore forming agents, e.g. pore inducing or porogenic agents}
- 20/3071 . . . {Washing or leaching}

20/3078	. . {Thermal treatment, e.g. calcining or pyrolyzing}	20/3253	. . . . . {comprising a cyclic structure not containing any of the heteroatoms nitrogen, oxygen or sulfur, e.g. aromatic structures}
20/3085	. . {Chemical treatments not covered by groups <a href="#">B01J 20/3007</a> - <a href="#">B01J 20/3078</a> }	20/3255	. . . . . {comprising a cyclic structure containing at least one of the heteroatoms nitrogen, oxygen or sulfur, e.g. heterocyclic or heteroaromatic structures}
20/3092	. . {Packing of a container, e.g. packing a cartridge or column (of chromatography columns <a href="#">B01D 15/206</a> )}	20/3257	. . . . . {the functional group or the linking, spacer or anchoring group as a whole comprising at least one of the heteroatoms nitrogen, oxygen or sulfur together with at least one silicon atom, these atoms not being part of the carrier as such}
20/32	. . Impregnating or coating {; Solid sorbent compositions obtained from processes involving impregnating or coating}	20/3259	. . . . . {comprising at least two different types of heteroatoms selected from nitrogen, oxygen or sulfur with at least one silicon atom}
20/3202	. . . {characterised by the carrier, support or substrate used for impregnation or coating}	20/3261	. . . . . {comprising a cyclic structure not containing any of the heteroatoms nitrogen, oxygen or sulfur, e.g. aromatic structures}
20/3204	. . . . {Inorganic carriers, supports or substrates}	20/3263	. . . . . {comprising a cyclic structure containing at least one of the heteroatoms nitrogen, oxygen or sulfur, e.g. an heterocyclic or heteroaromatic structure}
20/3206	. . . . {Organic carriers, supports or substrates}	20/3265	. . . . . {with an organic functional group containing a metal, e.g. a metal affinity ligand}
20/3208	. . . . . {Polymeric carriers, supports or substrates}	20/3268	. . . . . {Macromolecular compounds}
20/321	. . . . . {consisting of a polymer obtained by reactions involving only carbon to carbon unsaturated bonds}	20/327	. . . . . {Polymers obtained by reactions involving only carbon to carbon unsaturated bonds}
20/3212	. . . . . {consisting of a polymer obtained by reactions otherwise than involving only carbon to carbon unsaturated bonds}	20/3272	. . . . . {Polymers obtained by reactions otherwise than involving only carbon to carbon unsaturated bonds}
20/3214	. . . {characterised by the method for obtaining this coating or impregnating}	20/3274	. . . . . {Proteins, nucleic acids, polysaccharides, antibodies or antigens}
20/3217	. . . . {Resulting in a chemical bond between the coating or impregnating layer and the carrier, support or substrate, e.g. a covalent bond}	20/3276	. . . . . {Copolymers}
20/3219	. . . . . {involving a particular spacer or linking group, e.g. for attaching an active group}	20/3278	. . . . . {Polymers being grafted on the carrier}
20/3221	. . . . . {the chemical bond being an ionic interaction}	20/328	. . . . . {Polymers on the carrier being further modified}
20/3223	. . . . {by means of an adhesive agent}	20/3282	. . . . . {Crosslinked polymers}
20/3225	. . . . {involving a post-treatment of the coated or impregnated product}	20/3285	. . . . . {Coating or impregnation layers comprising different type of functional groups or interactions, e.g. different ligands in various parts of the sorbent, mixed mode, dual zone, bimodal, multimodal, ionic or hydrophobic, cationic or anionic, hydrophilic or hydrophobic}
20/3227	. . . . . {by end-capping, i.e. with or after the introduction of functional or ligand groups}	20/3287	. . . . . {Layers in the form of a liquid}
20/3229	. . . . . {for preventing leaching, leaking of attached functional or ligand groups}	20/3289	. . . . . {Coatings involving more than one layer of same or different nature}
20/3231	. . . {characterised by the coating or impregnating layer}	20/3291	. . . {Characterised by the shape of the carrier, the coating or the obtained coated product}
20/3234	. . . . {Inorganic material layers}	20/3293	. . . . {Coatings on a core, the core being particle or fiber shaped, e.g. encapsulated particles, coated fibers}
20/3236	. . . . . {containing metal, other than zeolites, e.g. oxides, hydroxides, sulphides or salts}	20/3295	. . . . {Coatings made of particles, nanoparticles, fibers, nanofibers}
20/3238	. . . . . {containing any type of zeolite}	20/3297	. . . . {Coatings in the shape of a sheet}
20/324	. . . . . {containing free carbon, e.g. activated carbon}		
20/3242	. . . . . {Layers with a functional group, e.g. an affinity material, a ligand, a reactant or a complexing group}		
20/3244	. . . . . {Non-macromolecular compounds}		
20/3246	. . . . . {having a well defined chemical structure}		
20/3248	. . . . . {the functional group or the linking, spacer or anchoring group as a whole comprising at least one type of heteroatom selected from a nitrogen, oxygen or sulfur, these atoms not being part of the carrier as such}		
20/3251	. . . . . {comprising at least two different types of heteroatoms selected from nitrogen, oxygen or sulphur}		



20/34	. . Regenerating or reactivating	23/08	. of gallium, indium or thallium
20/3408	. . . {of aluminosilicate molecular sieves}	23/10	. of rare earths
20/3416	. . . {of sorbents or filter aids comprising free carbon, e.g. activated carbon}	23/12	. of actinides
20/3425	. . . {of sorbents or filter aids comprising organic materials}	23/14	. of germanium, tin or lead
20/3433	. . . {of sorbents or filter aids other than those covered by <a href="#">B01J 20/3408</a> - <a href="#">B01J 20/3425</a> }	23/16	. of arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
20/3441	. . . {Regeneration or reactivation by electric current, ultrasound or irradiation, e.g. electromagnetic radiation such as X-rays, UV, light, microwaves}	23/18	. . Arsenic, antimony or bismuth
20/345	. . . {using a particular desorbing compound or mixture (elution or regeneration of stationary phases in liquid chromatography <a href="#">B01D 15/08</a> )}	23/20	. . Vanadium, niobium or tantalum
20/3458	. . . . {in the gas phase}	23/22	. . . Vanadium
20/3466	. . . . {with steam}	23/24	. . Chromium, molybdenum or tungsten
20/3475	. . . . {in the liquid phase}	23/26	. . . Chromium
20/3483	. . . {by thermal treatment not covered by groups <a href="#">B01J 20/3441</a> - <a href="#">B01J 20/3475</a> , e.g. by heating or cooling}	23/28	. . . Molybdenum
20/3491	. . . {by pressure treatment}	23/30	. . . Tungsten
<b>21/00</b>	<b>Catalysts comprising the elements, oxides, or hydroxides of magnesium, boron, aluminium, carbon, silicon, titanium, zirconium, or hafnium</b>	23/31	. . . combined with bismuth
21/005	. {Spinel}	23/32	. . Manganese, technetium or rhenium
21/02	. Boron or aluminium; Oxides or hydroxides thereof	23/34	. . . Manganese
21/04	. . Alumina	23/36	. . . Rhenium
21/06	. Silicon, titanium, zirconium or hafnium; Oxides or hydroxides thereof	23/38	. of noble metals
21/063	. . {Titanium; Oxides or hydroxides thereof}	23/40	. . of the platinum group metals
21/066	. . {Zirconium or hafnium; Oxides or hydroxides thereof}	23/42	. . . Platinum
21/08	. . Silica	23/44	. . . Palladium
21/10	. Magnesium; Oxides or hydroxides thereof	23/46	. . . Ruthenium, rhodium, osmium or iridium
21/12	. Silica and alumina	23/462	. . . . {Ruthenium}
21/14	. Silica and magnesia	23/464	. . . . {Rhodium}
21/16	. Clays or other mineral silicates	23/466	. . . . {Osmium}
21/18	. Carbon	23/468	. . . . {Iridium}
21/185	. . {Carbon nanotubes (carbon nanotubes per se <a href="#">C01B 32/15</a> )}	23/48	. . Silver or gold
21/20	. Regeneration or reactivation	23/50	. . . Silver
<b>23/00</b>	<b>Catalysts comprising metals or metal oxides or hydroxides, not provided for in group <a href="#">B01J 21/00</a> (<a href="#">B01J 21/16</a> takes precedence)</b>	23/52	. . . Gold
23/002	. {Mixed oxides other than spinels, e.g. perovskite}	23/54	. . combined with metals, oxides or hydroxides provided for in groups <a href="#">B01J 23/02</a> - <a href="#">B01J 23/36</a>
	<b>NOTE</b>	23/56	. . . Platinum group metals
	In group <a href="#">B01J 23/002</a> , elements constituting the exemplified mixed oxide are further indexed under the form of a C-set with <a href="#">B01J 2523/00</a> as base symbol using the relevant classification symbols of <a href="#">B01J 2523/10</a> - <a href="#">B01J 2523/847</a> , in numerical order, as further symbols and separated by ",", e.g. the mixed oxide $\text{Mo}_x\text{V}_y\text{Te}_z\text{O}_x$ is classified as ( <a href="#">B01J 2523/00</a> , <a href="#">B01J 2523/55</a> , <a href="#">B01J 2523/64</a> , <a href="#">B01J 2523/68</a> ).	23/58	. . . . with alkali- or alkaline earth metals
23/005	. {Spinel}	23/60	. . . . with zinc, cadmium or mercury
23/007	. {Mixed salts}	23/62	. . . . with gallium, indium, thallium, germanium, tin or lead
23/02	. of the alkali- or alkaline earth metals or beryllium	23/622	. . . . . {with germanium, tin or lead}
23/04	. . Alkali metals	23/624	. . . . . {with germanium}
23/06	. of zinc, cadmium or mercury	23/626	. . . . . {with tin}
		23/628	. . . . . {with lead}
		23/63	. . . . with rare earths or actinides
		23/64	. . . . with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
		23/644	. . . . . Arsenic, antimony or bismuth
		23/6442	. . . . . {Arsenic}
		23/6445	. . . . . {Antimony}
		23/6447	. . . . . {Bismuth}
		23/648	. . . . . Vanadium, niobium or tantalum {or polonium}
		23/6482	. . . . . {Vanadium}
		23/6484	. . . . . {Niobium}
		23/6486	. . . . . {Tantalum}
		23/6488	. . . . . {Polonium}
		23/652	. . . . . Chromium, molybdenum or tungsten
		23/6522	. . . . . {Chromium}
		23/6525	. . . . . {Molybdenum}
		23/6527	. . . . . {Tungsten}
		23/656	. . . . . Manganese, technetium or rhenium
		23/6562	. . . . . {Manganese}

23/6565	. . . . . {Technetium}	23/8876	. . . . . {Arsenic, antimony or bismuth}
23/6567	. . . . . {Rhenium}	23/8877	. . . . . {Vanadium, tantalum, niobium or polonium}
23/66	. . . Silver or gold		
23/68	. . . . with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	23/8878	. . . . . {Chromium}
23/681	. . . . . {with arsenic, antimony or bismuth}	23/888	. . . . . Tungsten
23/682	. . . . . {with vanadium, niobium, tantalum or polonium}	23/8885	. . . . . {containing also molybdenum}
23/683	. . . . . {with chromium, molybdenum or tungsten}	23/889	. . . . Manganese, technetium or rhenium
23/685	. . . . . {with chromium}	23/8892	. . . . . {Manganese}
23/686	. . . . . {with molybdenum}	23/8894	. . . . . {Technetium}
23/687	. . . . . {with tungsten}	23/8896	. . . . . {Rhenium}
23/688	. . . . . {with manganese, technetium or rhenium}	23/8898	. . . . . {containing also molybdenum}
23/70	. of the iron group metals or copper	23/89	. . combined with noble metals
23/72	. . Copper	23/8906	. . . {Iron and noble metals}
23/74	. . Iron group metals	23/8913	. . . {Cobalt and noble metals}
23/745	. . . Iron	23/892	. . . {Nickel and noble metals}
23/75	. . . Cobalt	23/8926	. . . {Copper and noble metals}
23/755	. . . Nickel	23/8933	. . . {also combined with metals, or metal oxides or hydroxides provided for in groups <a href="#">B01J 23/02</a> - <a href="#">B01J 23/36</a> }
23/76	. . combined with metals, oxides or hydroxides provided for in groups <a href="#">B01J 23/02</a> - <a href="#">B01J 23/36</a>	23/894	. . . . . {with rare earths or actinides}
23/78	. . . with alkali- or alkaline earth metals	23/8946	. . . . . {with alkali or alkaline earth metals}
23/80	. . . with zinc, cadmium or mercury	23/8953	. . . . . {with zinc, cadmium or mercury}
23/825	. . . with gallium, indium or thallium	23/896	. . . . . {with gallium, indium or thallium}
23/83	. . . with rare earths or actinides	23/8966	. . . . . {with germanium, tin or lead}
23/835	. . . with germanium, tin or lead	23/8973	. . . . . {with arsenic, antimony or bismuth}
23/84	. . . with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	23/898	. . . . . {with vanadium, tantalum, niobium or polonium}
23/843	. . . . Arsenic, antimony or bismuth	23/8986	. . . . . {with manganese, technetium or rhenium}
23/8432	. . . . . {Arsenic}	23/8993	. . . . . {with chromium, molybdenum or tungsten}
23/8435	. . . . . {Antimony}	23/90	. Regeneration or reactivation
23/8437	. . . . . {Bismuth}	23/92	. . of catalysts comprising metals, oxides or hydroxides provided for in groups <a href="#">B01J 23/02</a> - <a href="#">B01J 23/36</a>
23/847	. . . . Vanadium, niobium or tantalum {or polonium}	23/94	. . of catalysts comprising metals, oxides or hydroxides of the iron group metals or copper
23/8472	. . . . . {Vanadium}	23/96	. . of catalysts comprising metals, oxides or hydroxides of the noble metals
23/8474	. . . . . {Niobium}		
23/8476	. . . . . {Tantalum}	<b>25/00</b>	<b>Catalysts of the Raney type</b>
23/8478	. . . . . {Polonium}	25/02	. Raney nickel
23/85	. . . . Chromium, molybdenum or tungsten	25/04	. Regeneration or reactivation
23/86	. . . . . Chromium	<b>27/00</b>	<b>Catalysts comprising the elements or compounds of halogens, sulfur, selenium, tellurium, phosphorus or nitrogen; Catalysts comprising carbon compounds</b>
23/862	. . . . . {Iron and chromium}		<b>NOTE</b>
23/864	. . . . . {Cobalt and chromium}		Metal catalysts or metal oxide catalysts activated or conditioned by halogens, sulfur or phosphorus, or compounds thereof are classified in the appropriate groups for metal or metal oxide catalysts
23/866	. . . . . {Nickel and chromium}		
23/868	. . . . . {copper and chromium}		
23/88	. . . . . Molybdenum		
23/881	. . . . . and iron	27/02	. Sulfur, selenium or tellurium; Compounds thereof
23/882	. . . . . and cobalt	27/04	. . Sulfides
23/883	. . . . . and nickel	27/043	. . . with iron group metals or platinum group metals
23/885	. . . . . and copper	27/045	. . . . Platinum group metals
23/887	. . . . . containing in addition other metals, oxides or hydroxides provided for in groups <a href="#">B01J 23/02</a> - <a href="#">B01J 23/36</a>	27/047	. . . with chromium, molybdenum, tungsten or polonium
23/8871	. . . . . {Rare earth metals or actinides}	27/049	. . . . with iron group metals or platinum group metals
23/8872	. . . . . {Alkali or alkaline earth metals}	27/051	. . . . Molybdenum
23/8873	. . . . . {Zinc, cadmium or mercury}		
23/8874	. . . . . {Gallium, indium or thallium}		
23/8875	. . . . . {Germanium, tin or lead}		

27/0515	. . . . . {with iron group metals or platinum group metals}	27/24	. Nitrogen compounds
27/053	. . Sulfates	27/25	. . Nitrates
27/055	. . . with alkali metals, copper, gold or silver	27/26	. . Cyanides
27/057	. . Selenium or tellurium; Compounds thereof	27/28	. Regeneration or reactivation
27/0573	. . . {Selenium; Compounds thereof}	27/285	. . {of catalysts comprising compounds of phosphorus}
27/0576	. . . {Tellurium; Compounds thereof}	27/30	. . of catalysts comprising compounds of sulfur, selenium or tellurium
27/06	. Halogens; Compounds thereof	27/32	. . of catalysts comprising compounds of halogens
27/08	. . Halides	<b>29/00</b>	<b>Catalysts comprising molecular sieves {(molecular sieves per se C01B)}</b>
27/10	. . . Chlorides		<b>NOTES</b>
27/12	. . . Fluorides		1. In this group, the following term is used with the meaning indicated:
27/122	. . . of copper		• "zeolites" means:
27/125	. . with scandium, yttrium, aluminium, gallium, indium or thallium		i. crystalline aluminosilicates with base-exchange and molecular sieve properties, having three dimensional, microporous lattice framework structure of tetrahedral oxide units;
27/128	. . with iron group metals or platinum group metals		ii. compounds isomorphous to those of the former category, wherein the aluminium or silicon atoms in the framework are partly or wholly replaced by atoms of other elements, e.g. by gallium, germanium, phosphorus or boron.
27/13	. . . Platinum group metals		2. If metals are introduced into the framework of the molecular sieve already in the synthesis stage, <a href="#">B01J 29/86</a> - <a href="#">B01J 29/89</a> take precedence.
27/132	. . with chromium, molybdenum, tungsten or polonium		3. Mixtures of molecular sieves are classified in <a href="#">B01J 29/005</a> or <a href="#">B01J 29/80</a> and receive indexing codes chosen from groups <a href="#">B01J 29/03</a> - <a href="#">B01J 29/89</a> to identify the individual constituents of these mixtures
27/135	. . with titanium, zirconium, hafnium, germanium, tin or lead		
27/138	. . with alkaline earth metals, magnesium, beryllium, zinc, cadmium or mercury		
27/14	. Phosphorus; Compounds thereof		
27/16	. . containing oxygen {, i.e. acids, anhydrides and their derivatives with N, S, B or halogens without carriers or on carriers based on C, Si, Al or Zr; also salts of Si, Al and Zr}		
27/18	. . . with metals {other than Al or Zr}		
27/1802	. . . . {Salts or mixtures of anhydrides with compounds of other metals than V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, e.g. phosphates, thiophosphates}		
27/1804	. . . . . {with rare earths or actinides}	29/005	. {Mixtures of molecular sieves comprising at least one molecular sieve which is not an aluminosilicate zeolite, e.g. from groups <a href="#">B01J 29/03</a> - <a href="#">B01J 29/049</a> or <a href="#">B01J 29/82</a> - <a href="#">B01J 29/89</a> }
27/1806	. . . . . {with alkaline or alkaline earth metals}	29/03	. not having base-exchange properties {( <a href="#">B01J 29/005</a> takes precedence)}
27/1808	. . . . . {with zinc, cadmium or mercury}	29/0308	. . {Mesoporous materials not having base exchange properties, e.g. Si-MCM-41}
27/1811	. . . . . {with gallium, indium or thallium}	29/0316	. . . {containing iron group metals, noble metals or copper}
27/1813	. . . . . {with germanium, tin or lead}	29/0325	. . . . . {Noble metals}
27/1815	. . . . . {with arsenic, antimony or bismuth}	29/0333	. . . . . {Iron group metals or copper}
27/1817	. . . . . {with copper, silver or gold}	29/0341	. . . {containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium}
27/182	. . with silicon	29/035	. . {Microporous crystalline materials not having base exchange properties, such as} silica polymorphs, e.g. silicalites
27/185	. . with iron group metals or platinum group metals	29/0352	. . . {containing iron group metals, noble metals or copper}
27/1853	. . . {with iron, cobalt or nickel}	29/0354	. . . . . {Noble metals}
27/1856	. . . {with platinum group metals}	29/0356	. . . . . {Iron group metals or copper}
27/186	. . with arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	29/0358	. . . {containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium}
27/187	. . . with manganese, technetium or rhenium	29/04	. having base-exchange properties, e.g. crystalline zeolites {( <a href="#">B01J 29/005</a> takes precedence)}
27/188	. . . with chromium, molybdenum, tungsten or polonium		
27/19	. . . . Molybdenum		
27/192	. . . . . with bismuth		
27/195	. . . with vanadium, niobium or tantalum		
27/198	. . . . Vanadium		
27/199	. . . . . with chromium, molybdenum, tungsten or polonium		
27/20	. Carbon compounds		
27/22	. . Carbides		
27/224	. . . Silicon carbide		
27/228	. . . . with phosphorus, arsenic, antimony or bismuth		
27/232	. . Carbonates		
27/236	. . . Hydroxy carbonates		

29/041	. . {Mesoporous materials having base exchange properties, e.g. Si/Al-MCM-41}	29/20	. . . . containing iron group metals, noble metals or copper
29/042	. . . {containing iron group metals, noble metals or copper}	29/22	. . . . . Noble metals
29/043	. . . . {Noble metals}	29/24	. . . . . Iron group metals or copper
29/044	. . . . {Iron group metals or copper}	29/26	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/045	. . . {containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium}	29/40	. . . of the pentasil type, e.g. types ZSM-5, ZSM-8 or ZSM-11, as exemplified by patent documents US3702886, GB1334243 and US3709979, respectively
29/046	. . {Chromiasilicates; Aluminochromosilicates (B01J 29/005 takes precedence)}	29/405	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/047	. . {Germanosilicates; Aluminogermanosilicates (B01J 29/005 takes precedence)}	29/42	. . . . containing iron group metals, noble metals or copper
29/048	. . {Zincosilicates, Aluminozincosilicates (B01J 29/005 takes precedence)}	29/44	. . . . . Noble metals
29/049	. . {Pillared clays}	29/46	. . . . . Iron group metals or copper
29/06	. . Crystalline aluminosilicate zeolites; Isomorphous compounds thereof	29/48	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/061	. . . {containing metallic elements added to the zeolite}	29/50	. . . of the erionite or offretite type, e.g. zeolite T, as exemplified by patent document US2950952
2029/062	. . . {Mixtures of different aluminosilicates}	29/505	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/064	. . . containing iron group metals, noble metals or copper	29/52	. . . . containing iron group metals, noble metals or copper
29/068	. . . . Noble metals	29/54	. . . . . Noble metals
29/072	. . . . Iron group metals or copper	29/56	. . . . . Iron group metals or copper
29/076	. . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	29/58	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/08	. . . of the faujasite type, e.g. type X or Y	29/60	. . . of the type L, as exemplified by patent document US3216789
2029/081	. . . . {Increasing the silica/alumina ratio; Desalumination}	29/605	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/082	. . . . {X-type faujasite}	29/61	. . . . containing iron group metals, noble metals or copper
29/084	. . . . {Y-type faujasite}	29/62	. . . . . Noble metals
29/085	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}	29/63	. . . . . Iron group metals or copper
29/087	. . . . . {X-type faujasite}	29/64	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/088	. . . . . {Y-type faujasite}	29/65	. . . of the ferrierite type, e.g. types ZSM-21, ZSM-35 or ZSM-38, as exemplified by patent documents US4046859, US4016245 and US4046859, respectively
29/10	. . . . containing iron group metals, noble metals or copper	29/655	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}
29/103	. . . . . {X-type faujasite}	29/66	. . . . containing iron group metals, noble metals or copper
29/106	. . . . . {Y-type faujasite}	29/67	. . . . . Noble metals
29/12	. . . . . Noble metals	29/68	. . . . . Iron group metals or copper
29/123	. . . . . {X-type faujasite}		
29/126	. . . . . {Y-type faujasite}		
29/14	. . . . . Iron group metals or copper		
29/143	. . . . . {X-type faujasite}		
29/146	. . . . . {Y-type faujasite}		
29/16	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium		
29/163	. . . . . {X-type faujasite}		
29/166	. . . . . {Y-type faujasite}		
29/18	. . . of the mordenite type		
29/185	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}		



29/69	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium	29/7284	. . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}
29/70	. . . of types characterised by their specific structure not provided for in groups <a href="#">B01J 29/08</a> - <a href="#">B01J 29/65</a>	29/7292	. . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}
29/7003	. . . . {A-type}	29/74	. . . . Noble metals
29/7007	. . . . {Zeolite Beta}	29/7407	. . . . {A-type}
29/7011	. . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}	29/7415	. . . . {Zeolite Beta}
29/7015	. . . . {CHA-type, e.g. Chabazite, LZ-218}	29/7423	. . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}
29/7019	. . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}	29/743	. . . . {CHA-type, e.g. Chabazite, LZ-218}
29/7023	. . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}	29/7438	. . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}
29/7026	. . . . {MFS-type, e.g. ZSM-57}	29/7446	. . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}
29/703	. . . . {MRE-type, e.g. ZSM-48}	29/7453	. . . . {MFS-type, e.g. ZSM-57}
29/7034	. . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}	29/7461	. . . . {MRE-type, e.g. ZSM-48}
29/7038	. . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}	29/7469	. . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}
29/7042	. . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}	29/7476	. . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}
29/7046	. . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}	29/7484	. . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}
29/7049	. . . . {containing rare earth elements, titanium, zirconium, hafnium, zinc, cadmium, mercury, gallium, indium, thallium, tin or lead}	29/7492	. . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}
29/7053	. . . . {A-type}	29/76	. . . . Iron group metals or copper
29/7057	. . . . {Zeolite Beta}	29/7607	. . . . {A-type}
29/7061	. . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}	29/7615	. . . . {Zeolite Beta}
29/7065	. . . . {CHA-type, e.g. Chabazite, LZ-218}	29/7623	. . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}
29/7069	. . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}	29/763	. . . . {CHA-type, e.g. Chabazite, LZ-218}
29/7073	. . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}	29/7638	. . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}
29/7076	. . . . {MFS-type, e.g. ZSM-57}	29/7646	. . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}
29/708	. . . . {MRE-type, e.g. ZSM-48}	29/7653	. . . . {MFS-type, e.g. ZSM-57}
29/7084	. . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}	29/7661	. . . . {MRE-type, e.g. ZSM-48}
29/7088	. . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}	29/7669	. . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}
29/7092	. . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}	29/7676	. . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}
29/7096	. . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}	29/7684	. . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}
29/72	. . . . containing iron group metals, noble metals or copper	29/7692	. . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}
29/7207	. . . . {A-type}	29/78	. . . . containing arsenic, antimony, bismuth, vanadium, niobium, tantalum, polonium, chromium, molybdenum, tungsten, manganese, technetium or rhenium
29/7215	. . . . {Zeolite Beta}	29/7807	. . . . {A-type}
29/7223	. . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}	29/7815	. . . . {Zeolite Beta}
29/723	. . . . {CHA-type, e.g. Chabazite, LZ-218}	29/7823	. . . . {MAZ-type, e.g. Mazzite, Omega, ZSM-4 or LZ-202}
29/7238	. . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}	29/783	. . . . {CHA-type, e.g. Chabazite, LZ-218}
29/7246	. . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}	29/7838	. . . . {EMT-type, e.g. EMC-2, ECR-30, CSZ-1, ZSM-3 or ZSM-20}
29/7253	. . . . {MFS-type, e.g. ZSM-57}	29/7846	. . . . {EUO-type, e.g. EU-1, TPZ-3 or ZSM-50}
29/7261	. . . . {MRE-type, e.g. ZSM-48}	29/7853	. . . . {MFS-type, e.g. ZSM-57}
29/7269	. . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}	29/7861	. . . . {MRE-type, e.g. ZSM-48}
29/7276	. . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}	29/7869	. . . . {MTW-type, e.g. ZSM-12, NU-13, TPZ-12 or Theta-3}
		29/7876	. . . . {MWW-type, e.g. MCM-22, ERB-1, ITQ-1, PSH-3 or SSZ-25}

- 29/7884 . . . . . {TON-type, e.g. Theta-1, ISI-1, KZ-2, NU-10 or ZSM-22}
- 29/7892 . . . . . {MTT-type, e.g. ZSM-23, KZ-1, ISI-4 or EU-13}
- 29/80 . . . Mixtures of different zeolites
- 29/82 . Phosphates {[\(B01J 29/005 takes precedence\)](#)}
- 29/83 . . Aluminophosphates (APO compounds)
- 29/84 . . Aluminophosphates containing other elements, e.g. metals, boron
- 29/85 . . . Silicoaluminophosphates (SAPO compounds)
- 29/86 . Borosilicates; Aluminoborosilicates {[\(B01J 29/005 takes precedence\)](#)}
- 29/87 . Gallosilicates; Aluminogallosilicates; Galloborosilicates {[\(B01J 29/005 takes precedence\)](#)}
- 29/88 . Ferrosilicates; Ferroaluminosilicates {[\(B01J 29/005 takes precedence\)](#)}
- 29/89 . Silicates, aluminosilicates or borosilicates of titanium, zirconium or hafnium {[\(B01J 29/005 takes precedence\)](#)}
- 29/90 . Regeneration or reactivation

**31/00 Catalysts comprising hydrides, coordination complexes or organic compounds (catalyst compositions used only in polymerisation reactions C08 (; catalytic antibodies C12N 9/0002))**

**NOTES**

- Group [B01J 31/003](#) takes precedence over groups [B01J 31/02](#) - [B01J 31/24](#) (catalytic antibodies [C12N 9/0002](#))
- In this group, the following terms or expressions are used with the meanings indicated:
  - "Organic compound" a compound in which carbon is bonded to
    - a second carbon;
    - at least one atom of hydrogen or halogen; or
    - nitrogen by a single or double bond; except cyanic acid (HOCN), cyanogen (NCCN), cyanamide (H<sub>2</sub>NCN), cyanogen halide (HalCN), hydrocyanic acid (HCN) isocyanic acid (HNCO) fulminic acid (HCNO) and metal carbides (MCCM) (catalysts comprising any of these exceptions or their salts [B01J 27/20](#) - [B01J 27/26](#)).
  - "Organometallic compounds" includes all organic compounds wherein a metal or metalloid atom is bonded directly to a carbon fragment, the latter being formally anionic, no further neutral ligands being coordinated to the metal and the compound requiring no further cations for charge balance; e.g. M(1-CR<sub>3</sub>)<sub>n</sub> with M= main group metal, n= valency of metal and R= H or hydrocarbyl. (Compounds comprising anionic organonitrogen, organooxygen and organosulfur fragments, excluding carboxylates, with a metal bonded to these heteroatoms [B01J 31/02](#) - [B01J 31/0254](#); unsaturated carbon fragments in combination with transition metals [B01J 31/2282](#)).
  - "Coordination complexes" includes any donor-acceptor compounds or complex ions comprising organic or inorganic, anionic or neutral Lewis basic ligands, attached to a

Lewis acid central metal or metal ion through one or several complexing donor atoms with at least one lone-pair of electrons, e.g. N, O, S, P, to provide at least a Sigma-bond. Typically the maximum number of same or different ligands according to the coordination number, spatial requirements of the ligand and electronic configuration of the metal is bound in a predictable geometry. Complexes of neutral, cationic or anionic hydrocarbon ligands with delocalised charge and/or bonding site, e.g. Pd-olefin complexes or metallocenes, are also included (the following groups take precedence: simple hydrocarbyl metal compounds, e.g. of main group metal(oids) [B01J 31/12](#); oxoacid salts [B01J 31/04](#) - [B01J 31/10](#); other compounds comprising anionic organonitrogen, organooxygen and organosulfur fragments with a metal bonded to these heteroatoms [B01J 31/02](#) - [B01J 31/0254](#)).

- "Organometallic complexes" includes all coordination complexes comprising a M-C bond, e.g. metal carbonyls (complex cyanides such as M<sub>4</sub>[Fe(CN)<sub>6</sub>] [B01J 27/26](#)). Included are furthermore complexes which are not strictly organometallic *per se*, e.g. comprising only N, O, S and/or P coordinated ligands, but are described as involving, or known to involve, organometallic intermediates and/or transition states during use, e.g. Group 8-10 metal complexes for a variety of catalytic reactions or steps thereof, such as oxidative addition, e.g. of ArX, hydrogenation, carbonylation, epoxidation, etc.
- "Organic complexes" includes all coordination complexes comprising organic ligands (groups [B01J 31/1608](#) - [B01J 31/1895](#) take precedence).
- "Polymer" includes any macromolecular substance (typically M>10000 g/mol), which comprises repeating units made up of one or several kinds of atoms or groups of atoms, which are identically connected to one another. Oligomers, i.e. more than two identical repeating units connected to one another and typically 500<M<10000 g/mol, are grouped with the respective polymers (polymers *per se* [C08](#)).

- In this group, if two or more aspects are of equal importance, these are each classified, e.g. two components in a catalyst system such as:
  - support and pendant or otherwise immobilised coordination complex; or
  - coordination complex and essential additive.
 However, if two components, even if separately added, are described as forming, or known to form, a coordination complex, only the latter is classified, e.g. phosphine and Group 8-10 metal such as rhodium. The groups [B01J 31/26](#) - [B01J 31/38](#) are not to be used for the central metals in coordination complexes but rather for separately added further inorganic ingredients. Each specifically disclosed alternative is separately classified, i.e. specifically disclosed by ways of worked examples, specific claims and/or explicit alternatives therein.

B01J 31/00

(continued)

4. {When classifying in [B01J 31/00](#), additional information for the catalysts is provided as follows:
- (4-1) the specifically disclosed intended uses are indexed in [B01J 2231/00](#);
- (4-2) general aspects of the complexes of group [B01J 31/16](#) and the specifically disclosed central metal(s) therein, as well as additional information regarding any special solvents used for any catalyst system of this group are indexed in [B01J 2531/00](#).
- (4-3) conceptual articles, e.g. reviews, are separately indexed in [B01J 2231/005](#) and [B01J 2531/001](#);
- (4-4) additional information regarding the complexes or ligands classified in [B01J 31/16](#) - [B01J 31/24](#) and indexed in [B01J 2531/00](#) is indexed in [B01J 2540/00](#), e.g. non-coordinating substituents on the ligand periphery}
- 31/003 . {containing enzymes}
- NOTE**
- In this group, the presence of water is disregarded for classification purposes
- 31/006 . {comprising organic radicals, e.g. TEMPO}
- 31/02 . containing organic compounds or metal hydrides
- 31/0201 . . {Oxygen-containing compounds}
- 31/0202 . . . {Alcohols or phenols}
- 31/0204 . . . {Ethers}
- 31/0205 . . . {comprising carbonyl groups or oxygen-containing derivatives, e.g. acetals, ketals, cyclic peroxides}
- 31/0207 . . . . {Aldehydes or acetals}
- 31/0208 . . . . {Ketones or ketals}
- 31/0209 . . . {Esters of carboxylic or carbonic acids}
- 31/0211 . . . {with a metal-oxygen link}
- 31/0212 . . . . {Alkoxyates}
- 31/0214 . . . . {Aryloxyates, e.g. phenolates}
- 31/0215 . . {Sulfur-containing compounds}
- 31/0217 . . . {Mercaptans or thiols}
- 31/0218 . . . {Sulfides}
- 31/022 . . . . {Disulfides}
- 31/0221 . . . . {Polysulfides}
- 31/0222 . . . {comprising sulfonyl groups}
- 31/0224 . . . . {being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional compounds}
- 31/0225 . . . {comprising sulfonic acid groups or the corresponding salts}
- 31/0227 . . . . {being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional compounds}
- 31/0228 . . . {with a metal-sulfur link, e.g. mercaptides}
- 31/0229 . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0214](#)}
- 31/0231 . . {Halogen-containing compounds}
- 31/0232 . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0228](#) (perfluorinated sulfonyl compounds or moieties [B01J 31/0224](#); perfluorosulfonic acids [B01J 31/0227](#))}
- 31/0234 . . . {Nitrogen-, phosphorus-, arsenic- or antimony-containing compounds}
- 31/0235 . . . . {Nitrogen containing compounds}
- 31/0237 . . . . . {Amines}
- 31/0238 . . . . . {with a primary amino group}
- 31/0239 . . . . . {Quaternary ammonium compounds}
- 31/0241 . . . . . {Imines or enamines}
- 31/0242 . . . . . {Enamines}
- 31/0244 . . . . . {with nitrogen contained as ring member in aromatic compounds or moieties, e.g. pyridine}
- 31/0245 . . . . . {being derivatives of carboxylic or carbonic acids}
- 31/0247 . . . . . {Imides, amides or imidates (R-C=NR(OR))}
- 31/0248 . . . . . {Nitriles}
- 31/0249 . . . . . {Ureas (R<sub>2</sub>N-C(=O)-NR<sub>2</sub>)}
- 31/0251 . . . . . {Guanidides (R<sub>2</sub>N-C(=NR)-NR<sub>2</sub>)}
- 31/0252 . . . . . {with a metal-nitrogen link, e.g. metal amides, metal guanidides}
- 31/0254 . . . . . {on mineral substrates}
- 31/0255 . . . . {Phosphorus containing compounds}
- 31/0257 . . . . . {Phosphorus acids or phosphorus acid esters}
- 31/0258 . . . . . {Phosphoric acid mono-, di- or triesters ((RO)(R'O)2P=O), i.e. R= C, R'= C, H}
- 31/0259 . . . . . {comprising phosphorous acid (-ester) groups ((RO)P(OR')2) or the isomeric phosphonic acid (-ester) groups (R(R'O)2P=O), i.e. R= C, R'= C, H}
- 31/0261 . . . . . {comprising phosphonous acid (-ester) groups (RP(OR')2) or the isomeric phosphinic acid (-ester) groups (R2(R'O)P=O), i.e. R= C, R'= C, H}
- 31/0262 . . . . . {comprising phosphinous acid (-ester) groups (R2P(OR')) or the isomeric phosphine oxide groups (R3P=O), i.e. R= C, R'= C, H}
- 31/0264 . . . . . {Phosphorus acid amides}
- 31/0265 . . . . . {Phosphazenes, oligomers thereof or the corresponding phosphazanium salts ([polyphosphazenes per se C07F 9/067](#))}
- 31/0267 . . . . . {Phosphines or phosphonium compounds, i.e. phosphorus bonded to at least one carbon atom, including sp<sup>2</sup>-hybridised phosphorus compounds such as phosphabenzene, the other atoms bonded to phosphorus being either carbon or hydrogen}
- 31/0268 . . . . . {Phosphonium compounds, i.e. phosphine with an additional hydrogen or carbon atom bonded to phosphorous so as to result in a formal positive charge on phosphorous}
- 31/0269 . . . . . {on mineral substrates}
- 31/0271 . . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0231](#)}
- 31/0272 . . . {containing elements other than those covered by [B01J 31/0201](#) - [B01J 31/0255](#)}
- 31/0274 . . . . {containing silicon (ligands in coordination complexes [B01J 31/1608](#))}
- 31/0275 . . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0269](#)}

- 31/0277 . . . {comprising ionic liquids, as components in catalyst systems or catalysts *per se*, the ionic liquid compounds being used in the molten state at the respective reaction temperature}
- 31/0278 . . . . {containing nitrogen as cationic centre}
- 31/0279 . . . . . {the cationic portion being acyclic or nitrogen being a substituent on a ring}
- 31/0281 . . . . . {the nitrogen being a ring member}
- 31/0282 . . . . . {of an aliphatic ring, e.g. morpholinium}
- 31/0284 . . . . . {of an aromatic ring, e.g. pyridinium}
- 31/0285 . . . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0274](#)}
- 31/0287 . . . . {containing atoms other than nitrogen as cationic centre}
- 31/0288 . . . . . {Phosphorus}
- 31/0289 . . . . . {Sulfur}
- 31/0291 . . . . . {also containing elements or functional groups covered by [B01J 31/0201](#) - [B01J 31/0274](#)}
- 31/0292 . . . . {immobilised on a substrate}
- 31/0294 . . . . . {by polar or ionic interaction with the substrate, e.g. glass}
- 31/0295 . . . . . {by covalent attachment to the substrate, e.g. silica}
- 31/0297 . . . . . {the substrate being a soluble polymer, dendrimer or oligomer of characteristic microstructure of groups [B01J 31/061](#) - [B01J 31/068](#)}
- 31/0298 . . . . {the ionic liquids being characterised by the counter-anions}
- 31/04 . . . containing carboxylic acids or their salts {[B01J 31/0277](#) - [B01J 31/0298](#) take precedence; multi-metal carboxylate complexes like Pd (II) acetate, i.e. Pd<sub>3</sub> (OAc)<sub>6</sub> or Cr(II)acetate, i.e. Cr<sub>2</sub>(OAc)<sub>4</sub> [B01J 31/2226](#)}
- 31/06 . . . containing polymers {(organometallic polymers [B01J 31/123](#); polymer-bound organometallic complexes [B01J 31/165](#); coordination polymers [B01J 31/1691](#))}
- 31/061 . . . . {Chiral polymers}
- 31/062 . . . . . {Polymeric amino acids}
- 31/063 . . . . {Polymers comprising a characteristic microstructure}
- 31/064 . . . . . {Dendrimers}
- 31/065 . . . . . {Cyclodextrins}
- 31/066 . . . . . {Calixarenes and hetero-analogues, e.g. thiacalixarenes}
- 31/067 . . . . . {Molecularly imprinted polymers (catalytic antibodies [C12N 9/0002](#))}
- 31/068 . . . . {Polyalkylene glycols}
- 31/069 . . . . {Hybrid organic-inorganic polymers, e.g. silica derivatized with organic groups (nitrogen containing groups on mineral substrates [B01J 31/0254](#); organometallic polymers [B01J 31/123](#); coordination complexes immobilised on an inorganic support [B01J 31/1616](#); coordination polymers, e.g. metal-organic frameworks [B01J 31/1691](#))}
- 31/08 . . . . Ion-exchange resins
- 31/10 . . . . . sulfonated
- 31/12 . . . containing organo-metallic compounds or metal hydrides
- 31/121 . . . . {Metal hydrides}
- 31/122 . . . . . {Metal aryl or alkyl compounds}
- 31/123 . . . . . {Organometallic polymers, e.g. comprising C-Si bonds in the main chain or in subunits grafted to the main chain ([B01J 31/064](#), [B01J 31/066](#), [B01J 31/067](#), [B01J 31/08](#) and [B01J 31/10](#) take precedence; polymer-bound organometallic complexes [B01J 31/165](#); coordination polymers [B01J 31/1691](#); catalysts for the preparation of polysiloxanes, e.g. Karstedt catalysts [C08G 77/08](#))}
- 31/124 . . . . . {Silicones or siloxanes or comprising such units}
- 31/125 . . . . . {Cyclic siloxanes}
- 31/126 . . . . . {the siloxanes or siloxane units, cyclic or not, comprising an additional Si-H bond, e.g. polyhydromethylsiloxane [PHMS]}
- 31/127 . . . . . {the siloxane units, e.g. silsesquioxane units, being grafted onto other polymers or inorganic supports, e.g. via an organic linker}
- 31/128 . . . . {Mixtures of organometallic compounds}
- 31/14 . . . . . of aluminium or boron
- 31/143 . . . . . {of aluminium}
- 31/146 . . . . . {of boron}
- 31/16 . . . containing coordination complexes
- 31/1608 . . . . {the ligands containing silicon}
- 31/1616 . . . {Coordination complexes, e.g. organometallic complexes, immobilised on an inorganic support, e.g. ship-in-a-bottle type catalysts (catalysts comprising molecular sieves [B01J 29/00](#))}
- 31/1625 . . . . {immobilised by covalent linkages, i.e. pendant complexes with optional linking groups}
- 31/1633 . . . . . {covalent linkages via silicon containing groups}
- 31/1641 . . . . . {established via a metathesis reaction using a silicon-containing olefin}
- 31/165 . . . {Polymer immobilised coordination complexes, e.g. organometallic complexes}
- 31/1658 . . . . {immobilised by covalent linkages, i.e. pendant complexes with optional linking groups, e.g. on Wang or Merrifield resins}
- 31/1666 . . . . . {the linkage established via an olefin metathesis reaction}
- 31/1675 . . . . . {the linkage being to an organometallic polymer covered by groups [B01J 31/123](#) - [B01J 31/127](#), e.g. polyhydrosiloxanes}
- 31/1683 . . . . . {the linkage being to a soluble polymer, e.g. PEG or dendrimer, i.e. molecular weight enlarged complexes}
- 31/1691 . . . {Coordination polymers, e.g. metal-organic frameworks [MOF] (preparation of metal complexes containing carboxylic acid moieties [C07C 51/418](#); MOF's *per se* [C07F](#))}
- 31/18 . . . containing nitrogen, phosphorus, arsenic or antimony {as complexing atoms, e.g. in pyridine ligands, or in resonance therewith, e.g. in isocyanide ligands C=N-R or as complexed central atoms (double metal cyanides [B01J 27/26](#); N-heterocyclic carbenes [B01J 31/2265](#))}
- 31/1805 . . . . {the ligands containing nitrogen}
- 31/181 . . . . . {Cyclic ligands, including non-condensed polycyclic ligands, comprising at least one complexing nitrogen atom as ring member, e.g. pyridine}



31/1815	. . . . . {with more than one complexing nitrogen atom, e.g. bipyridyl, 2-aminopyridine}	31/2252	. . . . . {Sulfonate ligands}
31/182	. . . . . {comprising aliphatic or saturated rings}	31/2256	. . . . . {being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional ligands}
31/1825	. . . . . {Ligands comprising condensed ring systems, e.g. acridine, carbazole}	31/226	. . . . . {Sulfur, e.g. thiocarbamates}
31/183	. . . . . {with more than one complexing nitrogen atom, e.g. phenanthroline}	31/2265	. . . . . {Carbenes or carbynes, i.e.(image)}
31/1835	. . . . . {comprising aliphatic or saturated rings}	31/2269	. . . . . {Heterocyclic carbenes}
31/184	. . . . . {mixed aromatic/aliphatic ring systems, e.g. indoline}	31/2273	. . . . . {with only nitrogen as heteroatomic ring members, e.g. 1,3-diarylimidazoline-2-ylidenes}
31/1845	. . . {the ligands containing phosphorus (phosphines <a href="#">B01J 31/24</a> )}	31/2278	. . . . . {Complexes comprising two carbene ligands differing from each other, e.g. Grubbs second generation catalysts}
31/185	. . . . . {Phosphites ((RO)3P), their isomeric phosphonates (R(RO)2P=O) and RO-substitution derivatives thereof}	31/2282	. . . . . {Unsaturated compounds used as ligands}
31/1855	. . . . . {Triamide derivatives thereof}	31/2286	. . . . . {Alkynes, e.g. acetylides}
31/186	. . . . . {Mono- or diamide derivatives thereof}	31/2291	. . . . . {Olefins}
31/1865	. . . . . {Phosphonites (RP(OR)2), their isomeric phosphinates (R2(RO)P=O) and RO-substitution derivatives thereof}	31/2295	. . . . . {Cyclic compounds, e.g. cyclopentadienyls}
31/187	. . . . . {Amide derivatives thereof}	31/24	. . . Phosphines {, i.e. phosphorus bonded to only carbon atoms, or to both carbon and hydrogen atoms, including sp <sup>2</sup> -hybridised phosphorus compounds such as phosphabenzene, phosphole or anionic phospholide ligands ( <a href="#">complexes with parent phosphine PH<sub>3</sub> B01J 31/1845</a> )}
31/1875	. . . . . {Phosphinites (R <sub>2</sub> P(OR), their isomeric phosphine oxides (R <sub>3</sub> P=O) and RO-substitution derivatives thereof)}	31/2404	. . . . . {Cyclic ligands, including non-condensed polycyclic ligands, the phosphine-P atom being a ring member or a substituent on the ring}
31/188	. . . . . {Amide derivatives thereof}	31/2409	. . . . . {with more than one complexing phosphine-P atom}
31/1885	. . . . . {Ligands comprising two different formal oxidation states of phosphorus in one at least bidentate ligand, e.g. phosphite/phosphinite}	31/2414	. . . . . {comprising aliphatic or saturated rings}
31/189	. . . . . {containing both nitrogen and phosphorus as complexing atoms, including phosphino moieties, in one at least bidentate ligand}	31/2419	. . . . . {comprising P as ring member}
31/1895	. . . . . {the ligands containing arsenic or antimony}	31/2423	. . . . . {comprising aliphatic or saturated rings}
31/20	. . Carbonyls	31/2428	. . . . . {with more than one complexing phosphine-P atom}
31/22	. . Organic complexes	31/2433	. . . . . {comprising aliphatic or saturated rings}
31/2204	. . . . . {the ligands containing oxygen or sulfur as complexing atoms}	31/2438	. . . . . {and further hetero atoms as ring members, excluding the positions adjacent to P}
31/2208	. . . . . {Oxygen, e.g. acetylacetonates}	31/2442	. . . . . {comprising condensed ring systems}
31/2213	. . . . . {At least two complexing oxygen atoms present in an at least bidentate or bridging ligand}	31/2447	. . . . . {and phosphine-P atoms as substituents on a ring of the condensed system or on a further attached ring}
31/2217	. . . . . {At least one oxygen and one nitrogen atom present as complexing atoms in an at least bidentate or bridging ligand}	31/2452	. . . . . {with more than one complexing phosphine-P atom}
31/2221	. . . . . {At least one oxygen and one phosphorous atom present as complexing atoms in an at least bidentate or bridging ligand}	31/2457	. . . . . {comprising aliphatic or saturated rings, e.g. Xantphos}
31/2226	. . . . . {Anionic ligands, i.e. the overall ligand carries at least one formal negative charge}	31/2461	. . . . . {and phosphine-P atoms as ring members in the condensed ring system or in a further ring}
31/223	. . . . . {At least two oxygen atoms present in one at least bidentate or bridging ligand}	31/2466	. . . . . {comprising aliphatic or saturated rings}
31/2234	. . . . . {Beta-dicarbonyl ligands, e.g. acetylacetonates}	31/2471	. . . . . {with more than one complexing phosphine-P atom}
31/2239	. . . . . {Bridging ligands, e.g. OAc in Cr <sub>2</sub> (OAc) <sub>4</sub> , Pt <sub>4</sub> (OAc) <sub>8</sub> or dicarboxylate ligands}	31/2476	. . . . . {comprising aliphatic or saturated rings}
31/2243	. . . . . {At least one oxygen and one nitrogen atom present as complexing atoms in an at least bidentate or bridging ligand}	31/248	. . . . . {Bridged ring systems, e.g. 9-phosphabicyclononane}
31/2247	. . . . . {At least one oxygen and one phosphorous atom present as complexing atoms in an at least bidentate or bridging ligand}	31/2485	. . . . . {Tricyclic systems, e.g. phosphadamantanes and hetero analogues}
		31/249	. . . . . {Spiro-condensed ring systems}

- 31/2495 . . . {Ligands comprising a phosphine-P atom and one or more further complexing phosphorus atoms covered by groups [B01J 31/1845](#) - [B01J 31/1885](#), e.g. phosphine/phosphinate or phospholyl/phosphonate ligands}
- 31/26 . . containing in addition, inorganic metal compounds not provided for in groups [B01J 31/02](#) - [B01J 31/24](#)
- 31/28 . . of the platinum group metals, iron group metals or copper
- 31/30 . . . Halides
- 31/32 . . of manganese, technetium or rhenium
- 31/34 . . of chromium, molybdenum or tungsten
- 31/36 . . of vanadium, niobium or tantalum
- 31/38 . . of titanium, zirconium or hafnium
- 31/40 . . Regeneration or reactivation
- 31/4007 . . {of catalysts containing polymers}
- 31/4015 . . {of catalysts containing metals}
- 31/4023 . . . {containing iron group metals, noble metals or copper}
- 31/403 . . . . {containing iron group metals or copper}
- 31/4038 . . . . {containing noble metals}
- 31/4046 . . . . . {containing rhodium}
- 31/4053 . . . {with recovery of phosphorous catalyst system constituents}
- 31/4061 . . . {involving membrane separation}
- 31/4069 . . . {involving extraction with coordinating ionic liquids or supercritical fluids, e.g. CO<sub>2</sub>}
- 31/4076 . . . {involving electrochemical processes}
- 31/4084 . . . {involving electromagnetic wave energy, e.g. UV or visible light}
- 31/4092 . . . {involving a stripping step, with stripping gas or solvent}
- 32/00 Catalyst carriers in general**
- 33/00 Protection of catalysts, e.g. by coating**
- 35/00 Catalysts, in general, characterised by their form or physical properties**
- 35/0006 . {Catalysts containing parts with different compositions}
- 35/0013 . {Colloids}
- 35/002 . {Catalysts characterised by their physical properties}
- 35/0026 . . {Density}
- 35/0033 . . {Electric or magnetic properties}
- 35/004 . . {Photocatalysts}
- 35/0046 . . {Physical properties of the active metal ingredient}
- 35/0053 . . . {metal surface area}
- 35/006 . . . {metal crystallite size}
- 35/0066 . . . {metal dispersion value, e.g. percentage or fraction}
- 35/0073 . . {Distribution of the active metal ingredient}
- 35/008 . . . {egg-shell like}
- 35/0086 . . . {egg-yolk like}
- 35/0093 . . . {homogeneous throughout the support particle}
- 35/02 . Solids
- 35/023 . . {Catalysts characterised by dimensions, e.g. grain size}
- 35/026 . . {Form of the solid particles ([B01J 35/08](#) takes precedence)}
- 35/04 . . Foraminous structures, sieves, grids, honeycombs
- 35/06 . . Fabrics or filaments
- 35/065 . . . {Membranes}
- 35/08 . . Spheres
- 35/10 . . characterised by their surface properties or porosity
- 35/1004 . . . {Surface area}
- 35/1009 . . . . {less than 10 m<sup>2</sup>/g}
- 35/1014 . . . . {10-100 m<sup>2</sup>/g}
- 35/1019 . . . . {100-500 m<sup>2</sup>/g}
- 35/1023 . . . . {500-1000 m<sup>2</sup>/g}
- 35/1028 . . . . {more than 1000 m<sup>2</sup>/g}
- 35/1033 . . . {Pore volume}
- 35/1038 . . . . {less than 0.5 ml/g}
- 35/1042 . . . . {0.5-1.0 ml/g}
- 35/1047 . . . . {more than 1.0 ml/g}
- 35/1052 . . . {Pore diameter}
- 35/1057 . . . . {less than 2 nm}
- 35/1061 . . . . {2-50 nm}
- 35/1066 . . . . {50-500 nm}
- 35/1071 . . . . {500-1000 nm}
- 35/1076 . . . . {larger than 1000 nm}
- 35/108 . . . {Pore distribution}
- 35/1085 . . . . {monomodal}
- 35/109 . . . . {bimodal}
- 35/1095 . . . . {polymodal}
- 35/12 . Liquids or melts
- 37/00 Processes, in general, for preparing catalysts; Processes, in general, for activation of catalysts**
- 37/0009 . {Use of binding agents; Moulding; Pressing; Powdering; Granulating; Addition of materials ameliorating the mechanical properties of the product catalyst}
- 37/0018 . . {Addition of a binding agent or of material, later completely removed among others as result of heat treatment, leaching or washing, (e.g. forming of pores; protective layer, desintegrating by heat)}
- 37/0027 . . {Powdering}
- 37/0036 . . . {Grinding}
- 37/0045 . . . {Drying a slurry, e.g. spray drying}
- 37/0054 . . . {Drying of aerosols}
- 37/0063 . . {Granulating}
- 37/0072 . {Preparation of particles, e.g. dispersion of droplets in an oil bath}
- 37/0081 . {Preparation by melting}
- 37/009 . {Preparation by separation, e.g. by filtration, decantation, screening}
- 37/02 . Impregnation, coating or precipitation ([B01J 37/0009](#) and [B01J 37/0018](#) take precedence) ; protection by coating [B01J 33/00](#)
- 37/0201 . . {Impregnation}
- 37/0203 . . . {the impregnation liquid containing organic compounds}
- 37/0205 . . . {in several steps}
- 37/0207 . . . {Pretreatment of the support}
- 37/0209 . . . {involving a reaction between the support and a fluid}
- 37/0211 . . . {using a colloidal suspension}
- 37/0213 . . . {Preparation of the impregnating solution}
- 37/0215 . . {Coating}
- 37/0217 . . . {Pretreatment of the substrate before coating}
- 37/0219 . . . {the coating containing organic compounds}

- 37/0221 . . . {of particles}
- 37/0223 . . . . {by rotation}
- 37/0225 . . . {of metal substrates}
- 37/0226 . . . . {Oxidation of the substrate, e.g. anodisation}
- 37/0228 . . . {in several steps}
- 37/023 . . . {using molten compounds}
- 37/0232 . . . {by pulverisation}
- 37/0234 . . {Impregnation and coating simultaneously}
- 37/0236 . . {Drying, e.g. preparing a suspension, adding a soluble salt and drying}
- 37/0238 . . {via the gaseous phase-sublimation}
- 37/024 . . {Multiple impregnation or coating}
- 37/0242 . . . {Coating followed by impregnation}
- 37/0244 . . . {Coatings comprising several layers}
- 37/0246 . . . {Coatings comprising a zeolite}
- 37/0248 . . . {Coatings comprising impregnated particles}
- 37/03 . . Precipitation; Co-precipitation
- 37/031 . . . {Precipitation}
- 37/033 . . . . {Using Hydrolysis}
- 37/035 . . . . {Precipitation on carriers}
- 37/036 . . . {to form a gel or a cogel}
- 37/038 . . . {to form slurries or suspensions, e.g. a washcoat}
- 37/04 . . Mixing ([B01J 37/0009](#), [B01J 37/0018](#) take precedence)
- 37/06 . . Washing ([B01J 37/0009](#), [B01J 37/0018](#) take precedence)
- 37/08 . . Heat treatment ([B01J 37/0009](#), [B01J 37/0018](#) take precedence)
- 37/082 . . {Decomposition and pyrolysis}
- 37/084 . . . {Decomposition of carbon-containing compounds into carbon}
- 37/086 . . . {Decomposition of an organometallic compound, a metal complex or a metal salt of a carboxylic acid}
- 37/088 . . . {Decomposition of a metal salt}
- 37/10 . . in the presence of water, e.g. steam
- 37/105 . . . {Hydrolysis}
- 37/12 . . Oxidising
- 37/14 . . with gases containing free oxygen
- 37/16 . . Reducing
- 37/18 . . with gases containing free hydrogen
- 37/20 . . Sulfiding
- 37/22 . . Halogenating
- 37/24 . . Chlorinating
- 37/26 . . Fluorinating
- 37/28 . . Phosphorising
- 37/30 . . Ion-exchange
- 37/32 . . Freeze drying, i.e. lyophilisation
- 37/34 . . Irradiation by, or application of, electric, magnetic or wave energy, e.g. ultrasonic waves {; Ionic sputtering; Flame or plasma spraying; Particle radiation}
- 37/341 . . {making use of electric or magnetic fields, wave energy or particle radiation ([use of flames, plasma or lasers B01J 37/349](#))}
- 37/342 . . . {of electric, magnetic or electromagnetic fields, e.g. for magnetic separation}
- 37/343 . . . {of ultrasonic wave energy}
- 37/344 . . . {of electromagnetic wave energy}
- 37/345 . . . . {of ultraviolet wave energy}
- 37/346 . . . . {of microwave energy}
- 37/347 . . . {Ionic or cathodic spraying; Electric discharge}
- 37/348 . . {Electrochemical processes, e.g. electrochemical deposition or anodisation}
- 37/349 . . {making use of flames, plasmas or lasers}
- 37/36 . . Biochemical methods
- 38/00** **Regeneration or reactivation of catalysts, in general**
- 2038/005 . . {involving supercritical treatment}
- 38/02 . . Heat treatment
- 38/04 . . Gas or vapour treating; Treating by using liquids vaporisable upon contacting spent catalyst
- 38/06 . . using steam
- 38/08 . . using ammonia or derivatives thereof
- 38/10 . . using elemental hydrogen
- 38/12 . . Treating with free oxygen-containing gas
- 38/14 . . . with control of oxygen content in oxidation gas
- 38/16 . . . Oxidation gas comprising essentially steam and oxygen
- 38/18 . . . with subsequent reactive gas treating
- 38/20 . . . Plural distinct oxidation stages
- 38/22 . . . Moving bed, e.g. vertically or horizontally moving bulk
- 38/24 . . . . having mainly transverse, i.e. lateral, flow of oxygen-containing gas and material
- 38/26 . . . . having mainly counter-current flow of oxygen-containing gas and material
- 38/28 . . . . having mainly concurrent flow of oxygen-containing gas and material
- 38/30 . . . in gaseous suspension, e.g. fluidised bed
- 38/32 . . . . Indirectly heating or cooling material within regeneration zone or prior to entry into regeneration zone
- 38/34 . . . . with plural distinct serial combustion stages
- 38/36 . . . . and with substantially complete oxidation of carbon monoxide to carbon dioxide within regeneration zone
- 38/38 . . . and adding heat by solid heat carrier
- 38/40 . . . and forming useful by-products
- 38/42 . . using halogen-containing material
- 38/44 . . . and adding simultaneously or subsequently free oxygen; using oxyhalogen compound
- 38/46 . . . fluorine-containing
- 38/48 . . Liquid treating or treating in liquid phase, e.g. dissolved or suspended
- 38/485 . . {Impregnating or reimpregnating with, or deposition of metal compounds or catalytically active elements}
- 38/50 . . using organic liquids
- 38/52 . . . oxygen-containing
- 38/54 . . . halogen-containing
- 38/56 . . . Hydrocarbons
- 38/58 . . . and gas addition thereto
- 38/60 . . using acids
- 38/62 . . . organic
- 38/64 . . using alkaline material; using salts
- 38/66 . . . using ammonia or derivatives thereof
- 38/68 . . including substantial dissolution or chemical precipitation of a catalyst component in the ultimate reconstitution of the catalyst
- 38/70 . . Wet oxidation of material submerged in liquid
- 38/72 . . including segregation of diverse particles

- 38/74 . utilising ion-exchange
- Ion-exchange** (treatment of milk [A23C 9/14](#); separation by liquid ion-exchangers [B01D](#), e.g. [B01D 11/00](#); separation of isotopes [B01D 59/00](#); compounds *er se*, see the relevant classes, e.g. [C01](#), [C07](#), [C08](#); treatment of water [C02F 1/42](#); refining of hydrocarbon oils, in the absence of hydrogen, with solid sorbents [C10G 25/00](#); purification of sugar juices [C13B 20/14](#); extraction of sugar from molasses [C13B 35/06](#); extraction of metal compounds from ores or concentrates by wet processes [C22B 3/00](#); using ion-exchange for investigating or analysing materials [G01N 30/96](#); treating radioactively contaminated material [G21F 9/12](#))
- NOTES**
- In groups [B01J 39/00](#) - [B01J 49/00](#):
    - Ion-exchange covers all processes whereby ions are exchanged between the solid exchanger and the liquid to be treated and wherein the exchanger is not soluble in the liquid to be treated
    - Ion-exchange processes cover also ion-exchange in combination with complex or chelate forming reactions.
  - In groups [B01J 39/00](#) - [B01J 49/00](#), the last place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the last appropriate place.
  - {In groups [B01J 39/00](#) - [B01J 49/00](#), it is desirable to classify other constituents by using Combination sets with symbols chosen from [B01J 39/00](#) and subgroups and [B01J 41/00](#) and subgroups. }
- 39/00 Cation exchange; Use of material as cation exchangers; Treatment of material for improving the cation exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 39/02 . Processes using inorganic exchangers
- 39/04 . Processes using organic exchangers
- 39/05 . . in the strongly acidic form
- 39/07 . . in the weakly acidic form
- 39/08 . Use of material as cation exchangers; Treatment of material for improving the cation exchange properties
- 39/09 . . Inorganic material
- 39/10 . . Oxides or hydroxides
- 39/12 . . Compounds containing phosphorus
- 39/14 . . Base exchange silicates, e.g. zeolites
- 39/16 . . Organic material
- 39/17 . . . containing also inorganic materials, e.g. inert material coated with an ion-exchange resin
- 39/18 . . . Macromolecular compounds ([B01J 39/17](#) takes precedence)
- 39/19 . . . . obtained otherwise than by reactions only involving unsaturated carbon-to-carbon bonds
- 39/20 . . . . obtained by reactions only involving unsaturated carbon-to-carbon bonds
- 39/22 . . . . Cellulose or wood; Derivatives thereof
- 39/24 . . Carbon, coal or tar
- 39/26 . Cation exchangers for chromatographic processes
- 41/00 Anion exchange; Use of material as anion exchangers; Treatment of material for improving the anion exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 41/02 . Processes using inorganic exchangers
- 41/04 . Processes using organic exchangers
- 41/05 . . in the strongly basic form
- 41/07 . . in the weakly basic form
- 41/08 . Use of material as anion exchangers; Treatment of material for improving the anion exchange properties
- 41/09 . . Organic material
- 41/10 . . Inorganic material
- 41/12 . . Macromolecular compounds
- 41/13 . . . obtained otherwise than by reactions only involving unsaturated carbon-to-carbon bonds
- 41/14 . . . obtained by reactions only involving unsaturated carbon-to-carbon bonds
- 41/16 . . . Cellulose or wood; Derivatives thereof
- 41/18 . . Carbon, coal or tar
- 41/20 . Anion exchangers for chromatographic processes
- 43/00 Amphoteric ion-exchange, i.e. using ion-exchangers having cationic and anionic groups; Use of material as amphoteric ion-exchangers; Treatment of material for improving their amphoteric ion-exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 45/00 Ion-exchange in which a complex or a chelate is formed; Use of material as complex or chelate forming ion-exchangers; Treatment of material for improving the complex or chelate forming ion-exchange properties (ion-exchange chromatography processes [B01D 15/36](#))**
- 47/00 Ion-exchange processes in general; Apparatus therefor (ion-exchange chromatography processes or apparatus [B01D 15/08](#))**
- 47/011 . using batch processes
- 47/012 . using portable ion-exchange apparatus
- 47/014 . in which the adsorbent properties of the ion-exchanger are involved, e.g. recovery of proteins or other high-molecular compounds
- 47/015 . Electron-exchangers
- 47/016 . Modification or after-treatment of ion-exchangers
- 47/018 . Granulation; Incorporation of ion-exchangers in a matrix; Mixing with inert materials
- 47/019 . . Mixtures in form of tablets
- 47/02 . Column or bed processes
- 47/022 . . characterised by the construction of the column or container
- 47/024 . . . where the ion-exchangers are in a removable cartridge
- 47/026 . . using columns or beds of different ion exchange materials in series
- 47/028 . . . with alternately arranged cationic and anionic exchangers
- 47/04 . . Mixed-bed processes
- 47/06 . . during which the ion-exchange material is subjected to a physical treatment, e.g. heat, electric current, irradiation or vibration ([electrodialysis or electro-osmosis \[B01D 61/42\]\(#\)](#))
- 47/08 . . . subjected to a direct electric current
- 47/10 . with moving ion-exchange material; with ion-exchange material in suspension or in fluidised-bed form
- 47/11 . . in rotating beds
- 47/12 . characterised by the use of ion-exchange material in the form of ribbons, filaments, fibres or sheets, e.g. membranes ([electrodialysis or electro-osmosis \[B01D 61/42\]\(#\)](#))
- 47/127 . . in the form of filaments or fibres



- 47/133 . . Precoat filters
- 47/14 . Controlling or regulating
- 47/15 . . for obtaining a solution having a fixed pH
- 49/00 Regeneration or reactivation of ion-exchangers; Apparatus therefor (ion-exchange chromatography processes or apparatus B01D 15/08)**
- 49/05 . of fixed beds
- 49/06 . . containing cationic exchangers
- 49/07 . . containing anionic exchangers
- 49/08 . . containing cationic and anionic exchangers in separate beds
- 49/09 . . of mixed beds
- 49/10 . of moving beds
- 49/12 . . containing cationic exchangers
- 49/14 . . containing anionic exchangers
- 49/16 . . containing cationic and anionic exchangers in separate beds
- 49/18 . . of mixed beds
- 49/20 . of membranes
- 49/30 . Electrical regeneration
- 49/40 . Thermal regeneration
- 49/45 . . of amphoteric ion-exchangers
- 49/50 . characterised by the regeneration reagents
- 49/53 . . for cationic exchangers
- 49/57 . . for anionic exchangers
- 49/60 . Cleaning or rinsing ion-exchange beds
- 49/70 . for large scale industrial processes or applications
- 49/75 . of water softeners
- 49/80 . Automatic regeneration
- 49/85 . . Controlling or regulating devices therefor
- 49/90 . having devices which prevent back-flow of the ion-exchange mass during regeneration
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- 2203/00 Processes utilising sub- or super atmospheric pressure**
- 2203/06 . High pressure synthesis
- 2203/0605 . . Composition of the material to be processed
- 2203/061 . . . Graphite
- 2203/0615 . . . Fullerene
- 2203/062 . . . Diamond
- 2203/0625 . . . Carbon
- 2203/063 . . . Carbides
- 2203/0635 . . . . Silicon carbide
- 2203/064 . . . Carbonates
- 2203/0645 . . . Boronitrides
- 2203/065 . . Composition of the material produced
- 2203/0655 . . . Diamond
- 2203/066 . . . Boronitrides
- 2203/0665 . . . Gallium nitrides
- 2203/067 . . . Aluminium nitrides
- 2203/0675 . . Structural or physico-chemical features of the materials processed
- 2203/068 . . . Crystal growth
- 2203/0685 . . . Crystal sintering
- 2203/069 . . . Recrystallisation
- 2203/0695 . . . Colour change
- 2204/00 Aspects relating to feed or outlet devices; Regulating devices for feed or outlet devices**
- 2204/002 . the feeding side being of particular interest
- 2204/005 . the outlet side being of particular interest
- 2204/007 . Aspects relating to the heat-exchange of the feed or outlet devices
- 2208/00 Processes carried out in the presence of solid particles; Reactors therefor**
- 2208/00008 . Controlling the process
- 2208/00017 . . Controlling the temperature
- 2208/00026 . . . Controlling or regulating the heat exchange system
- 2208/00035 . . . . involving measured parameters
- 2208/00044 . . . . . Temperature measurement
- 2208/00053 . . . . . of the heat exchange medium
- 2208/00061 . . . . . of the reactants
- 2208/0007 . . . . . Pressure measurement
- 2208/00079 . . . . . Fluid level measurement
- 2208/00088 . . . . . Flow rate measurement
- 2208/00097 . . . . . Mathematical modelling
- 2208/00106 . . . by indirect heat exchange
- 2208/00115 . . . . with heat exchange elements inside the bed of solid particles
- 2208/00123 . . . . . Fingers
- 2208/00132 . . . . . Tubes
- 2208/00141 . . . . . Coils
- 2208/0015 . . . . . Plates; Cylinders
- 2208/00159 . . . . . Radially arranged plates
- 2208/00168 . . . . with heat exchange elements outside the bed of solid particles
- 2208/00176 . . . . . outside the reactor
- 2208/00185 . . . . . Fingers
- 2208/00194 . . . . . Tubes
- 2208/00203 . . . . . Coils
- 2208/00212 . . . . . Plates; Jackets; Cylinders
- 2208/00221 . . . . . comprising baffles for guiding the flow of the heat exchange medium
- 2208/0023 . . . . . with some catalyst tubes being empty, e.g. dummy tubes or flow-adjusting rods
- 2208/00238 . . . . . Adjusting the heat-exchange profile by adapting catalyst tubes or the distribution thereof, e.g. by using inserts in some of the tubes or adding external fins
- 2208/00247 . . . . . Reflux columns
- 2208/00256 . . . . . in a heat exchanger for the heat exchange medium separate from the reactor
- 2208/00265 . . . . Part of all of the reactants being heated or cooled outside the reactor while recycling
- 2208/00274 . . . . . involving reactant vapours
- 2208/00283 . . . . . involving reactant liquids
- 2208/00292 . . . . . involving reactant solids
- 2208/003 . . . . . involving reactant slurries
- 2208/00309 . . . . with two or more reactions in heat exchange with each other, such as an endothermic reaction in heat exchange with an exothermic reaction
- 2208/00318 . . . . Heat exchange inside a feeding nozzle or nozzle reactor
- 2208/00327 . . . by direct heat exchange
- 2208/00336 . . . . adding a temperature modifying medium to the reactants
- 2208/00345 . . . . . Cryogenic coolants
- 2208/00353 . . . . . Non-cryogenic fluids
- 2208/00362 . . . . . Liquid

- 2208/00371 . . . . . gaseous
- 2208/0038 . . . . . Solids
- 2208/00389 . . . using electric heating or cooling elements
- 2208/00398 . . . . inside the reactor bed
- 2208/00407 . . . . outside the reactor bed
- 2208/00415 . . . . electric resistance heaters
- 2208/00424 . . . . Peltier cooling elements
- 2208/00433 . . . using electromagnetic heating
- 2208/00442 . . . . Microwaves
- 2208/00451 . . . . Sunlight; Visible light
- 2208/0046 . . . . Infrared radiation
- 2208/00469 . . . . Radiofrequency
- 2208/00477 . . . by thermal insulation means
- 2208/00486 . . . . Vacuum spaces
- 2208/00495 . . . . using insulating materials or refractories
- 2208/00504 . . . by means of a burner
- 2208/00513 . . . using inert heat absorbing solids in the bed
- 2208/00522 . . . using inert heat absorbing solids outside the bed
- 2208/0053 . . . Controlling multiple zones along the direction of flow, e.g. pre-heating and after-cooling
- 2208/00539 . . Pressure
- 2208/00548 . . Flow
- 2208/00557 . . . controlling the residence time inside the reactor vessel
- 2208/00566 . . . Pulsated flow
- 2208/00575 . . Controlling the viscosity
- 2208/00584 . . Controlling the density
- 2208/00592 . . Controlling the pH
- 2208/00601 . . Controlling the conductivity
- 2208/0061 . . Controlling the level
- 2208/00619 . . Controlling the weight
- 2208/00628 . . Controlling the composition of the reactive mixture
- 2208/00637 . . . Means for stopping or slowing down the reaction
- 2208/00646 . . . Means for starting up the reaction
- 2208/00654 . . by measures relating to the particulate material
- 2208/00663 . . . Concentration
- 2208/00672 . . . Particle size selection
- 2208/00681 . . . Agglomeration
- 2208/0069 . . . Attrition
- 2208/00699 . . . Moisture content regulation
- 2208/00707 . . . Fouling
- 2208/00716 . . Means for reactor start-up
- 2208/00725 . . Mathematical modelling
- 2208/00734 . . Controlling static charge
- 2208/00743 . Feeding or discharging of solids
- 2208/00752 . . Feeding
- 2208/00761 . . Discharging
- 2208/00769 . . Details of feeding or discharging
- 2208/00778 . . . Kinetic energy reducing devices in the flow channel
- 2208/00787 . . . Bringing the solid in the form of a slurry before feeding it to the reactor
- 2208/00796 . Details of the reactor or of the particulate material
- 2208/00805 . . Details of the particulate material
- 2208/00814 . . . the particulate material being provided in prefilled containers
- 2208/00823 . . Mixing elements
- 2208/00831 . . . Stationary elements
- 2208/0084 . . . . inside the bed, e.g. baffles
- 2208/00849 . . . . outside the bed, e.g. baffles
- 2208/00858 . . . Moving elements
- 2208/00867 . . . . inside the bed, e.g. rotary mixer
- 2208/00876 . . . . outside the bed, e.g. rotary mixer
- 2208/00884 . . Means for supporting the bed of particles, e.g. grids, bars, perforated plates
- 2208/00893 . . Feeding means for the reactants
- 2208/00902 . . . Nozzle-type feeding elements
- 2208/00911 . . . Sparger-type feeding elements
- 2208/0092 . . . Perforated plates
- 2208/00929 . . . Provided with baffles
- 2208/00938 . . Flow distribution elements
- 2208/00946 . . Features relating to the reactants or products
- 2208/00955 . . . Sampling of the particulate material, the reactants or the products
- 2208/00964 . . . . Reactants
- 2208/00973 . . . . Products
- 2208/00982 . . . . Particulate material
- 2208/00991 . . Disengagement zone in fluidised-bed reactors
- 2208/02 . . with stationary particles
- 2208/021 . . comprising a plurality of beds with flow of reactants in parallel
- 2208/022 . . . Plate-type reactors filled with granular catalyst
- 2208/023 . . Details
- 2208/024 . . . Particulate material
- 2208/025 . . . . Two or more types of catalyst
- 2208/026 . . . . comprising nanocatalysts
- 2208/027 . . . Beds
- 2208/028 . . . . rotating
- 2208/06 . . Details of tube reactors containing solid particles
- 2208/065 . . Heating or cooling the reactor
- 2219/00** **Chemical, physical or physico-chemical processes in general; Their relevant apparatus**
- 2219/00002 . Chemical plants
- 2219/00004 . . Scale aspects
- 2219/00006 . . . Large-scale industrial plants
- 2219/00009 . . . Pilot-scale plants
- 2219/00011 . . . Laboratory-scale plants
- 2219/00013 . . . . Miniplants
- 2219/00015 . . . Scale-up
- 2219/00018 . . Construction aspects
- 2219/0002 . . . Plants assembled from modules joined together
- 2219/00022 . . . Plants mounted on pallets or skids
- 2219/00024 . . . Revamping, retrofitting or modernisation of existing plants
- 2219/00027 . . Process aspects
- 2219/00029 . . . Batch processes
- 2219/00031 . . . Semi-batch or fed-batch processes
- 2219/00033 . . . Continuous processes
- 2219/00036 . . . Intermittent processes
- 2219/00038 . . . Processes in parallel
- 2219/0004 . . . Processes in series
- 2219/00042 . . Features relating to reactants and process fluids
- 2219/00045 . . . Green chemistry
- 2219/00047 . . . Ionic liquids
- 2219/00049 . Controlling or regulating processes
- 2219/00051 . . Controlling the temperature
- 2219/00054 . . . Controlling or regulating the heat exchange system
- 2219/00056 . . . . involving measured parameters
- 2219/00058 . . . . . Temperature measurement

- 2219/0006 . . . . . of the heat exchange medium
- 2219/00063 . . . . . of the reactants
- 2219/00065 . . . . . Pressure measurement
- 2219/00067 . . . . . Liquid level measurement
- 2219/00069 . . . . . Flow rate measurement
- 2219/00072 . . . . . Mathematical modelling
- 2219/00074 . . . . . by indirect heating or cooling employing heat exchange fluids
- 2219/00076 . . . . . with heat exchange elements inside the reactor
- 2219/00078 . . . . . Fingers
- 2219/00081 . . . . . Tubes
- 2219/00083 . . . . . Coils
- 2219/00085 . . . . . Plates; Jackets; Cylinders
- 2219/00087 . . . . . with heat exchange elements outside the reactor
- 2219/0009 . . . . . Coils
- 2219/00092 . . . . . Tubes
- 2219/00094 . . . . . Jackets
- 2219/00096 . . . . . Plates
- 2219/00099 . . . . . the reactor being immersed in the heat exchange medium
- 2219/00101 . . . . . Reflux columns
- 2219/00103 . . . . . in a heat exchanger separate from the reactor
- 2219/00105 . . . . . part or all of the reactants being heated or cooled outside the reactor while recycling
- 2219/00108 . . . . . involving reactant vapours
- 2219/0011 . . . . . involving reactant liquids
- 2219/00112 . . . . . involving reactant solids
- 2219/00114 . . . . . involving reactant slurries
- 2219/00117 . . . . . with two or more reactions in heat exchange with each other, such as an endothermic reaction in heat exchange with an exothermic reaction
- 2219/00119 . . . . . Heat exchange inside a feeding nozzle or nozzle reactor
- 2219/00121 . . . . . by direct heating or cooling
- 2219/00123 . . . . . adding a temperature modifying medium to the reactants
- 2219/00126 . . . . . Cryogenic coolants
- 2219/00128 . . . . . by evaporation of reactants
- 2219/0013 . . . . . by condensation of reactants
- 2219/00132 . . . . . using electric heating or cooling elements
- 2219/00135 . . . . . Electric resistance heaters
- 2219/00137 . . . . . Peltier cooling elements
- 2219/00139 . . . . . using electromagnetic heating
- 2219/00141 . . . . . Microwaves
- 2219/00144 . . . . . Sunlight; Visible light
- 2219/00146 . . . . . Infrared radiation
- 2219/00148 . . . . . Radiofrequency
- 2219/0015 . . . . . by thermal insulation means
- 2219/00153 . . . . . Vacuum spaces
- 2219/00155 . . . . . using insulating materials or refractories
- 2219/00157 . . . . . by means of a burner
- 2219/00159 . . . . . controlling multiple zones along the direction of flow, e.g. pre-heating and after-cooling
- 2219/00162 . . . . . controlling the pressure
- 2219/00164 . . . . . controlling the flow
- 2219/00166 . . . . . controlling the residence time inside the reactor vessel
- 2219/00168 . . . . . controlling the viscosity
- 2219/00171 . . . . . controlling the density
- 2219/00173 . . . . . Physical density
- 2219/00175 . . . . . Optical density
- 2219/00177 . . . . . controlling the pH
- 2219/0018 . . . . . controlling the conductivity
- 2219/00182 . . . . . controlling the level of reactants in the reactor vessel
- 2219/00184 . . . . . controlling the weight of reactants in the reactor vessel
- 2219/00186 . . . . . controlling the composition of the reactive mixture
- 2219/00189 . . . . . controlling the stirring velocity
- 2219/00191 . . . . . Control algorithm
- 2219/00193 . . . . . Sensing a parameter
- 2219/00195 . . . . . of the reaction system
- 2219/00198 . . . . . at the reactor inlet
- 2219/002 . . . . . inside the reactor
- 2219/00202 . . . . . at the reactor outlet
- 2219/00204 . . . . . of the heat exchange system
- 2219/00207 . . . . . other than of the reactor heat exchange system
- 2219/00209 . . . . . transforming a sensed parameter
- 2219/00211 . . . . . comparing a sensed parameter with a pre-set value
- 2219/00213 . . . . . Fixed parameter value
- 2219/00216 . . . . . Parameter value calculated by equations
- 2219/00218 . . . . . Dynamically variable (in-line) parameter values
- 2219/0022 . . . . . calculating difference
- 2219/00222 . . . . . taking actions
- 2219/00225 . . . . . stopping the system or generating an alarm
- 2219/00227 . . . . . modifying the operating conditions
- 2219/00229 . . . . . of the reaction system
- 2219/00231 . . . . . at the reactor inlet
- 2219/00234 . . . . . inside the reactor
- 2219/00236 . . . . . at the reactor outlet
- 2219/00238 . . . . . of the heat exchange system
- 2219/0024 . . . . . other than of the reactor or heat exchange system
- 2219/00243 . . . . . Mathematical modelling
- 2219/00245 . . . . . Avoiding undesirable reactions or side-effects
- 2219/00247 . . . . . Fouling of the reactor or the process equipment
- 2219/0025 . . . . . Foam formation
- 2219/00252 . . . . . Formation of deposits other than coke
- 2219/00254 . . . . . Formation of unwanted polymer, such as "pop-corn"
- 2219/00256 . . . . . Leakage
- 2219/00259 . . . . . Preventing runaway of the chemical reaction
- 2219/00261 . . . . . Predicting runaway of the chemical reaction
- 2219/00263 . . . . . Preventing explosion of the chemical mixture
- 2219/00265 . . . . . Preventing flame propagation
- 2219/00268 . . . . . Detecting faulty operations
- 2219/0027 . . . . . Pressure relief
- 2219/00272 . . . . . Addition of reaction inhibitor
- 2219/00274 . . . . . Sequential or parallel reactions; Apparatus and devices for combinatorial chemistry or for making arrays; Chemical library technology
- 2219/00277 . . . . . Apparatus
- 2219/00279 . . . . . Features relating to reactor vessels
- 2219/00281 . . . . . Individual reactor vessels
- 2219/00283 . . . . . Reactor vessels with top opening

2219/00286	. . . . .	Reactor vessels with top and bottom openings	2219/004	. . . . .	Pinch valves
2219/00288	. . . . .	in the shape of syringes	2219/00403	. . . . .	in multiple arrangements
2219/0029	. . . . .	with pistons or plungers	2219/00405	. . . . .	Sliding valves
2219/00292	. . . . .	in the shape of pipette tips	2219/00407	. . . . .	In multiple arrangements
2219/00295	. . . . .	the reactor vessels having pervious side walls	2219/00409	. . . . .	Solenoids in combination with valves
2219/00297	. . . . .	"Tea bags"	2219/00412	. . . . .	In multiple arrangements
2219/00299	. . . . .	Generally cylindrical reactor vessels	2219/00414	. . . . .	using suction
2219/00301	. . . . .	the reactor vessels having impervious side walls	2219/00416	. . . . .	Vacuum
2219/00304	. . . . .	Pouches	2219/00418	. . . . .	using pressure
2219/00306	. . . . .	Reactor vessels in a multiple arrangement	2219/00421	. . . . .	using centrifugation
2219/00308	. . . . .	interchangeably mounted in racks or blocks	2219/00423	. . . . .	using filtration, e.g. through porous frits
2219/0031	. . . . .	the racks or blocks being mounted in stacked arrangements	2219/00425	. . . . .	using decantation
2219/00313	. . . . .	the reactor vessels being formed by arrays of wells in blocks	2219/00427	. . . . .	using masks
2219/00315	. . . . .	Microtiter plates	2219/0043	. . . . .	for direct application of reagents, e.g. through openings in a shutter
2219/00317	. . . . .	Microwell devices, i.e. having large numbers of wells	2219/00432	. . . . .	Photolithographic masks
2219/00319	. . . . .	the blocks being mounted in stacked arrangements	2219/00434	. . . . .	Liquid crystal masks
2219/00322	. . . . .	the individual reactor vessels being arranged serially in stacks	2219/00436	. . . . .	Maskless processes
2219/00324	. . . . .	the reactor vessels or wells being arranged in plates moving in parallel to each other	2219/00439	. . . . .	using micromirror arrays
2219/00326	. . . . .	Movement by rotation	2219/00441	. . . . .	using lasers
2219/00328	. . . . .	Movement by linear translation	2219/00443	. . . . .	Thin film deposition
2219/00331	. . . . .	Details of the reactor vessels	2219/00445	. . . . .	Ion implantation
2219/00333	. . . . .	Closures attached to the reactor vessels	2219/00448	. . . . .	using microlens arrays
2219/00335	. . . . .	Septa	2219/0045	. . . . .	using optical fibres
2219/00337	. . . . .	Valves	2219/00452	. . . . .	Means for the recovery of reactants or products
2219/0034	. . . . .	in the shape of a ball or sphere	2219/00454	. . . . .	by chemical cleavage from the solid support
2219/00342	. . . . .	rotary	2219/00457	. . . . .	Dispensing or evacuation of the solid phase support
2219/00344	. . . . .	Caps	2219/00459	. . . . .	Beads
2219/00346	. . . . .	Screw-caps	2219/00461	. . . . .	Beads and reaction vessel together
2219/00349	. . . . .	Spheres	2219/00463	. . . . .	Directed sorting
2219/00351	. . . . .	Means for dispensing and evacuation of reagents	2219/00466	. . . . .	in a slurry
2219/00353	. . . . .	Pumps	2219/00468	. . . . .	by manipulation of individual beads
2219/00355	. . . . .	peristaltic	2219/0047	. . . . .	Pins
2219/00358	. . . . .	electrode driven	2219/00472	. . . . .	Replaceable crowns
2219/0036	. . . . .	Nozzles	2219/00475	. . . . .	Sheets
2219/00362	. . . . .	Acoustic nozzles	2219/00477	. . . . .	Means for pressurising the reaction vessels
2219/00364	. . . . .	Pipettes	2219/00479	. . . . .	Means for mixing reactants or products in the reaction vessels
2219/00367	. . . . .	capillary	2219/00481	. . . . .	by the use of moving stirrers within the reaction vessels
2219/00369	. . . . .	in multiple or parallel arrangements	2219/00484	. . . . .	by shaking, vibrating or oscillating of the reaction vessels
2219/00371	. . . . .	comprising electrodes	2219/00486	. . . . .	by sonication or ultrasonication
2219/00373	. . . . .	Hollow needles	2219/00488	. . . . .	by rotation of the reaction vessels
2219/00376	. . . . .	in multiple or parallel arrangements	2219/0049	. . . . .	by centrifugation
2219/00378	. . . . .	Piezo-electric or ink jet dispensers	2219/00493	. . . . .	by sparging or bubbling with gases
2219/0038	. . . . .	Drawing	2219/00495	. . . . .	Means for heating or cooling the reaction vessels
2219/00382	. . . . .	Stamping	2219/00497	. . . . .	Features relating to the solid phase supports
2219/00385	. . . . .	Printing	2219/005	. . . . .	Beads
2219/00387	. . . . .	Applications using probes	2219/00502	. . . . .	Particles of irregular geometry
2219/00389	. . . . .	Feeding through valves	2219/00504	. . . . .	Pins
2219/00391	. . . . .	Rotary valves	2219/00506	. . . . .	with removable crowns
2219/00394	. . . . .	in multiple arrangements	2219/00509	. . . . .	Microcolumns
2219/00396	. . . . .	Membrane valves	2219/00511	. . . . .	Walls of reactor vessels
2219/00398	. . . . .	in multiple arrangements	2219/00513	. . . . .	Essentially linear supports
			2219/00515	. . . . .	in the shape of strings
			2219/00518	. . . . .	in the shape of tapes
			2219/0052	. . . . .	in the shape of elongated tubes
			2219/00522	. . . . .	in a multiple parallel arrangement
			2219/00524	. . . . .	in the shape of fiber bundles



- 2219/00527 . . . . Sheets
- 2219/00529 . . . . DNA chips
- 2219/00531 . . . . essentially square
- 2219/00533 . . . . essentially rectangular
- 2219/00536 . . . . in the shape of disks
- 2219/00538 . . . . in the shape of cylinders
- 2219/0054 . . . Means for coding or tagging the apparatus or the reagents
- 2219/00542 . . . . Alphanumeric characters
- 2219/00545 . . . . Colours
- 2219/00547 . . . . Bar codes
- 2219/00549 . . . . 2-dimensional
- 2219/00551 . . . . 3-dimensional
- 2219/00554 . . . . Physical means
- 2219/00556 . . . . Perforations
- 2219/00558 . . . . Cuts-out
- 2219/0056 . . . . Raised or sunken areas
- 2219/00563 . . . . Magnetic means
- 2219/00565 . . . . Electromagnetic means
- 2219/00567 . . . . Transponder chips
- 2219/00569 . . . . EEPROM memory devices
- 2219/00572 . . . . Chemical means
- 2219/00574 . . . . radioactive
- 2219/00576 . . . . fluorophore
- 2219/00578 . . . . electrophoric
- 2219/00581 . . . . Mass
- 2219/00583 . . Features relative to the processes being carried out
- 2219/00585 . . . Parallel processes
- 2219/00587 . . . High throughput processes
- 2219/0059 . . . Sequential processes
- 2219/00592 . . . Split-and-pool, mix-and-divide processes
- 2219/00594 . . . Gas-phase processes
- 2219/00596 . . . Solid-phase processes
- 2219/00599 . . . Solution-phase processes
- 2219/00601 . . . High-pressure processes
- 2219/00603 . . . Making arrays on substantially continuous surfaces
- 2219/00605 . . . the compounds being directly bound or immobilised to solid supports
- 2219/00608 . . . . DNA chips
- 2219/0061 . . . . The surface being organic
- 2219/00612 . . . . the surface being inorganic
- 2219/00614 . . . . Delimitation of the attachment areas
- 2219/00617 . . . . . by chemical means
- 2219/00619 . . . . . using hydrophilic or hydrophobic regions
- 2219/00621 . . . . . by physical means, e.g. trenches, raised areas
- 2219/00623 . . . . Immobilisation or binding
- 2219/00626 . . . . Covalent
- 2219/00628 . . . . Ionic
- 2219/0063 . . . . Other, e.g. van der Waals forces, hydrogen bonding
- 2219/00632 . . . . Introduction of reactive groups to the surface
- 2219/00635 . . . . . by reactive plasma treatment
- 2219/00637 . . . . . by coating it with another layer
- 2219/00639 . . . . the compounds being trapped in or bound to a porous medium
- 2219/00641 . . . . the porous medium being continuous, e.g. porous oxide substrates
- 2219/00644 . . . . . the porous medium being present in discrete locations, e.g. gel pads
- 2219/00646 . . . . the compounds being bound to beads immobilised on the solid supports
- 2219/00648 . . . . . by the use of solid beads
- 2219/0065 . . . . . by the use of liquid beads
- 2219/00653 . . . . the compounds being bound to electrodes embedded in or on the solid supports
- 2219/00655 . . . . the compounds being bound to magnets embedded in or on the solid supports
- 2219/00657 . . . . One-dimensional arrays
- 2219/00659 . . . . Two-dimensional arrays
- 2219/00662 . . . . Two-dimensional arrays within two-dimensional arrays
- 2219/00664 . . . . Three-dimensional arrays
- 2219/00666 . . . . One-dimensional arrays within three-dimensional arrays
- 2219/00668 . . . . Two-dimensional arrays within three-dimensional arrays
- 2219/00671 . . . . Three-dimensional arrays within three-dimensional arrays
- 2219/00673 . . . . Slice arrays
- 2219/00675 . . . . In-situ synthesis on the substrate
- 2219/00677 . . . . Ex-situ synthesis followed by deposition on the substrate
- 2219/0068 . . . Means for controlling the apparatus of the process
- 2219/00682 . . . Manual means
- 2219/00684 . . . Semi-automatic means
- 2219/00686 . . . Automatic
- 2219/00689 . . . . using computers
- 2219/00691 . . . . using robots
- 2219/00693 . . . Means for quality control
- 2219/00695 . . . Synthesis control routines, e.g. using computer programs
- 2219/00698 . . . Measurement and control of process parameters
- 2219/007 . . . Simulation or virtual synthesis
- 2219/00702 . . . Processes involving means for analysing and characterising the products
- 2219/00704 . . . . integrated with the reactor apparatus
- 2219/00707 . . . . separated from the reactor apparatus
- 2219/00709 . . . Type of synthesis
- 2219/00711 . . . Light-directed synthesis
- 2219/00713 . . . Electrochemical synthesis
- 2219/00716 . . . Heat activated synthesis
- 2219/00718 . . . Type of compounds synthesised
- 2219/0072 . . . Organic compounds
- 2219/00722 . . . . Nucleotides
- 2219/00725 . . . . Peptides
- 2219/00727 . . . . Glycopeptides
- 2219/00729 . . . . Peptide nucleic acids [PNA]
- 2219/00731 . . . . Saccharides
- 2219/00734 . . . . Lipids
- 2219/00736 . . . . Non-biologic macromolecules, e.g. polymeric compounds
- 2219/00738 . . . . Organic catalysts
- 2219/0074 . . . . Biological products
- 2219/00743 . . . . Cells
- 2219/00745 . . . Inorganic compounds
- 2219/00747 . . . . Catalysts
- 2219/0075 . . . . Metal based compounds
- 2219/00752 . . . . Alloys
- 2219/00754 . . . . Metal oxides

- 2219/00756 . . . Compositions, e.g. coatings, crystals, formulations
- 2219/00759 . . Purification of compounds synthesised
- 2219/00761 . Details of the reactor
- 2219/00763 . . Baffles
- 2219/00765 . . . Baffles attached to the reactor wall
- 2219/00768 . . . . vertical
- 2219/0077 . . . . inclined
- 2219/00772 . . . . . in a helix
- 2219/00774 . . . . . in the form of cones
- 2219/00777 . . . . horizontal
- 2219/00779 . . . Baffles attached to the stirring means
- 2219/00781 . Aspects relating to microreactors
- 2219/00783 . . Laminate assemblies, i.e. the reactor comprising a stack of plates
- 2219/00786 . . . Geometry of the plates
- 2219/00788 . . Three-dimensional assemblies, i.e. the reactor comprising a form other than a stack of plates
- 2219/0079 . . . Monolith-base structure
- 2219/00792 . . . One or more tube-shaped elements
- 2219/00795 . . . . Spiral-shaped
- 2219/00797 . . . . Concentric tubes
- 2219/00799 . . . Cup-shaped
- 2219/00801 . . Means to assemble
- 2219/00804 . . . Plurality of plates
- 2219/00806 . . . . Frames
- 2219/00808 . . . . Sealing means
- 2219/0081 . . . Plurality of modules
- 2219/00813 . . . . Fluidic connections
- 2219/00815 . . . . Electric connections
- 2219/00817 . . . . Support structures
- 2219/00819 . . Materials of construction
- 2219/00822 . . . Metal
- 2219/00824 . . . Ceramic
- 2219/00826 . . . . Quartz
- 2219/00828 . . . . Silicon wafers or plates
- 2219/00831 . . . Glass
- 2219/00833 . . . Plastic
- 2219/00835 . . . Comprising catalytically active material
- 2219/00837 . . . comprising coatings other than catalytically active coatings
- 2219/0084 . . . . For changing surface tension
- 2219/00842 . . . . For protection channel surface, e.g. corrosion protection
- 2219/00844 . . . Comprising porous material
- 2219/00846 . . . comprising nanostructures, e.g. nanotubes
- 2219/00849 . . . comprising packing elements, e.g. glass beads
- 2219/00851 . . Additional features
- 2219/00853 . . . Employing electrode arrangements
- 2219/00855 . . . Surface features
- 2219/00858 . . . Aspects relating to the size of the reactor
- 2219/0086 . . . . Dimensions of the flow channels
- 2219/00862 . . . . Dimensions of the reaction cavity itself
- 2219/00864 . . . . Channel sizes in the nanometer range, e.g. nanoreactors
- 2219/00867 . . . Microreactors placed in series, on the same or on different supports
- 2219/00869 . . . Microreactors placed in parallel, on the same or on different supports
- 2219/00871 . . . Modular assembly
- 2219/00873 . . Heat exchange
- 2219/00876 . . . Insulation elements
- 2219/00878 . . . . Vacuum spaces
- 2219/0088 . . . Peltier-type elements
- 2219/00882 . . . Electromagnetic heating
- 2219/00885 . . . Thin film heaters
- 2219/00887 . . . Deflection means for heat or irradiation
- 2219/00889 . . Mixing ([micromixers B01F 13/0059](#))
- 2219/00891 . . Feeding or evacuation
- 2219/00894 . . . More than two inlets
- 2219/00896 . . . Changing inlet or outlet cross-section, e.g. pressure-drop compensation
- 2219/00898 . . . Macro-to-Micro (M2M)
- 2219/009 . . . Pulsating flow
- 2219/00903 . . . Segmented flow
- 2219/00905 . . Separation
- 2219/00907 . . . using membranes
- 2219/00909 . . . using filters
- 2219/00912 . . . by electrophoresis
- 2219/00914 . . . . by dielectrophoresis
- 2219/00916 . . . by chromatography
- 2219/00918 . . . by adsorption
- 2219/00921 . . . by absorption
- 2219/00923 . . . by surface tension
- 2219/00925 . . Irradiation
- 2219/00927 . . . Particle radiation or gamma-radiation
- 2219/0093 . . . Electric or magnetic energy
- 2219/00932 . . . Sonic or ultrasonic vibrations
- 2219/00934 . . . Electromagnetic waves
- 2219/00936 . . . . UV-radiations
- 2219/00939 . . . . X-rays
- 2219/00941 . . . . Microwaves
- 2219/00943 . . . . Visible light, e.g. sunlight
- 2219/00945 . . . . Infra-red light
- 2219/00948 . . . . Radiofrequency
- 2219/0095 . . Control aspects
- 2219/00952 . . . Sensing operations
- 2219/00954 . . . . Measured properties
- 2219/00957 . . . . . Compositions or concentrations
- 2219/00959 . . . . . Flow
- 2219/00961 . . . . . Temperature
- 2219/00963 . . . . . Pressure
- 2219/00966 . . . . . pH
- 2219/00968 . . . . Type of sensors
- 2219/0097 . . . . . Optical sensors
- 2219/00972 . . . . . Visible light
- 2219/00975 . . . . . Ultraviolet light
- 2219/00977 . . . . . Infrared light
- 2219/00979 . . . . . Acoustic sensors
- 2219/00981 . . . . . Gas sensors
- 2219/00984 . . . Residence time
- 2219/00986 . . . Microprocessor
- 2219/00988 . . . Leakage
- 2219/0099 . . Cleaning
- 2219/00993 . . Design aspects
- 2219/00995 . . . Mathematical modeling
- 2219/00997 . . . Strategical arrangements of multiple microreactor systems
- 2219/02 . . Apparatus characterised by their chemically-resistant properties
- 2219/0204 . . comprising coatings on the surfaces in direct contact with the reactive components
- 2219/0209 . . . of glass
- 2219/0213 . . . of enamel

- 2219/0218 . . . of ceramic
- 2219/0222 . . . . of porcelain
- 2219/0227 . . . of graphite
- 2219/0231 . . . of diamond
- 2219/0236 . . . Metal based
- 2219/024 . . . . Metal oxides
- 2219/0245 . . . of synthetic organic material
- 2219/025 . . characterised by the construction materials of the reactor vessel proper
- 2219/0254 . . . Glass
- 2219/0259 . . . Enamel
- 2219/0263 . . . Ceramic
- 2219/0268 . . . . Porcelain
- 2219/0272 . . . Graphite
- 2219/0277 . . . Metal based
- 2219/0281 . . . . Metal oxides
- 2219/0286 . . . . Steel
- 2219/029 . . . . Non-ferrous metals
- 2219/0295 . . . Synthetic organic materials
- 2219/08 . Processes employing the direct application of electric or wave energy, or particle radiation; Apparatus therefor
- 2219/0801 . . Controlling the process
- 2219/0803 . . employing electric or magnetic energy
- 2219/0805 . . . giving rise to electric discharges
- 2219/0807 . . . . involving electrodes
- 2219/0809 . . . . . employing two or more electrodes
- 2219/0811 . . . . . employing three electrodes
- 2219/0813 . . . . . employing four electrodes
- 2219/0815 . . . . . involving stationary electrodes
- 2219/0816 . . . . . involving moving electrodes
- 2219/0818 . . . . . Rotating electrodes
- 2219/082 . . . . . Sliding electrodes
- 2219/0822 . . . . . The electrode being consumed
- 2219/0824 . . . . . Details relating to the shape of the electrodes
- 2219/0826 . . . . . essentially linear
- 2219/0828 . . . . . Wires
- 2219/083 . . . . . cylindrical
- 2219/0832 . . . . . essentially toroidal
- 2219/0833 . . . . . forming part of a full circle
- 2219/0835 . . . . . substantially flat
- 2219/0837 . . . . . Details relating to the material of the electrodes
- 2219/0839 . . . . . Carbon
- 2219/0841 . . . . . Metal
- 2219/0843 . . . . . Ceramic
- 2219/0845 . . . . Details relating to the type of discharge
- 2219/0847 . . . . . Glow discharge
- 2219/0849 . . . . . Corona pulse discharge
- 2219/085 . . . creating magnetic fields
- 2219/0852 . . . employing permanent magnets
- 2219/0854 . . . employing electromagnets
- 2219/0856 . . . employing a combination of permanent and electromagnets
- 2219/0858 . . . employing moving elements
- 2219/086 . . . . Moving (electro)magnets
- 2219/0862 . . . . employing multiple (electro)magnets
- 2219/0864 . . . . . Three (electro)magnets
- 2219/0866 . . . . . Four (electro)magnets
- 2219/0867 . . . . . Six or more (electro)magnets
- 2219/0869 . . Feeding or evacuating the reactor
- 2219/0871 . . Heating or cooling of the reactor
- 2219/0873 . . Materials to be treated
- 2219/0875 . . . Gas
- 2219/0877 . . . Liquid
- 2219/0879 . . . Solid
- 2219/0881 . . . Two or more materials
- 2219/0883 . . . . Gas-gas
- 2219/0884 . . . . Gas-liquid
- 2219/0886 . . . . Gas-solid
- 2219/0888 . . . . Liquid-liquid
- 2219/089 . . . . Liquid-solid
- 2219/0892 . . . involving catalytically active material
- 2219/0894 . . Processes carried out in the presence of a plasma
- 2219/0896 . . . Cold plasma
- 2219/0898 . . . Hot plasma
- 2219/12 . . Processes employing electromagnetic waves
- 2219/1203 . . . Incoherent waves
- 2219/1206 . . . . Microwaves
- 2219/1209 . . . . . Features relating to the reactor or vessel
- 2219/1212 . . . . . Arrangements of the reactor or the reactors
- 2219/1215 . . . . . . Single reactor
- 2219/1218 . . . . . . Multiple reactors
- 2219/1221 . . . . . . the reactor per se
- 2219/1224 . . . . . . Form of the reactor
- 2219/1227 . . . . . . Reactors comprising tubes with open ends
- 2219/123 . . . . . . Vessels in the form of a cup
- 2219/1233 . . . . . . Closure means, such as lids, caps, seals ([B01J 3/03 takes precedence; pressure relief systems in the lid, e.g. rupture discs B01J 2219/0027](#))
- 2219/1236 . . . . . . . Frames for holding the lid in place
- 2219/1239 . . . . . . . Means for feeding and evacuation
- 2219/1242 . . . . . . . Materials of construction
- 2219/1245 . . . . . . . Parts of the reactor being microwave absorbing, dielectric
- 2219/1248 . . . . . Features relating to the microwave cavity
- 2219/1251 . . . . . Support for the reaction vessel
- 2219/1254 . . . . . Static supports
- 2219/1257 . . . . . Rotating supports
- 2219/126 . . . . . in the form of a closed housing
- 2219/1263 . . . . . in the form of an open housing or stand
- 2219/1266 . . . . . Microwave deflecting parts
- 2219/1269 . . . . . Microwave guides
- 2219/1272 . . . . . Materials of construction
- 2219/1275 . . . . . Controlling the microwave irradiation variables
- 2219/1278 . . . . . Time
- 2219/1281 . . . . . Frequency
- 2219/1284 . . . . . Intensity
- 2219/1287 . . . . . Features relating to the microwave source
- 2219/129 . . . . . Arrangements thereof
- 2219/1293 . . . . . . Single source
- 2219/1296 . . . . . . Multiple sources
- 2219/18 . . Details relating to the spatial orientation of the reactor
- 2219/182 . . horizontal
- 2219/185 . . vertical

- 2219/187 . . . inclined at an angle to the horizontal or to the vertical plane
- 2219/19 . Details relating to the geometry of the reactor
- 2219/192 . . . polygonal
- 2219/1921 . . . triangular
- 2219/1923 . . . square or square-derived
- 2219/1925 . . . prismatic
- 2219/1926 . . . pyramidal
- 2219/1928 . . . hexagonal
- 2219/194 . . . round
- 2219/1941 . . . circular or disk-shaped
- 2219/1942 . . . spherical
- 2219/1943 . . . cylindrical
- 2219/1944 . . . spiral
- 2219/1945 . . . toroidal
- 2219/1946 . . . conical
- 2219/1947 . . . oval or ellipsoidal
- 2219/1948 . . . ovoid or egg-shaped
- 2219/24 . Stationary reactors without moving elements inside
- 2219/2401 . . Reactors comprising multiple separate flow channels
- 2219/2402 . . . Monolithic-type reactors
- 2219/2403 . . . Geometry of the channels
- 2219/2404 . . . . Polygonal
- 2219/2406 . . . . Rectangular
- 2219/2407 . . . . Square
- 2219/2408 . . . . Circular or ellipsoidal
- 2219/2409 . . . . Heat exchange aspects
- 2219/2411 . . . . The reactant being in indirect heat exchange with a non reacting heat exchange medium
- 2219/2412 . . . . . Independent temperature control in various sections of the monolith
- 2219/2413 . . . . . Two reactions in indirect heat exchange
- 2219/2414 . . . . . The same reactant stream undergoing different reactions, endothermic or exothermic
- 2219/2416 . . . . . Additional heat exchange means, e.g. electric resistance heater, coils
- 2219/2417 . . . . . Direct heat exchange
- 2219/2418 . . . . . Feeding means
- 2219/2419 . . . . . for the reactants
- 2219/242 . . . . . for the catalysts
- 2219/2422 . . . . . Mixing means, e.g. fins or baffles attached to the monolith or placed in the channel
- 2219/2423 . . . . . Separation means, e.g. membrane inside the reactor
- 2219/2424 . . . . . Wall-flow filter, e.g. adjacent cells closed alternatively at their end to force the reactant stream through the walls of the monolith
- 2219/2425 . . . . . Construction materials
- 2219/2427 . . . . . Catalysts
- 2219/2428 . . . . . Catalysts coated on the surface of the monolith channels
- 2219/2429 . . . . . . Nanocatalysts
- 2219/243 . . . . . Catalyst in granular form in the channels
- 2219/2432 . . . . . Monoliths having catalytic activity on its own
- 2219/2433 . . . . . of the monoliths
- 2219/2434 . . . . . Metals or alloys
- 2219/2435 . . . . . Steel
- 2219/2437 . . . . . Metal oxides
- 2219/2438 . . . . . Ceramics
- 2219/2439 . . . . . Glass
- 2219/244 . . . . . Plastics
- 2219/2441 . . . . . Other constructional details
- 2219/2443 . . . . . Assembling means of monolith modules
- 2219/2444 . . . . . Size aspects
- 2219/2445 . . . . . Sizes
- 2219/2446 . . . . . Cell density
- 2219/2448 . . . . . Additional structures inserted in the channels
- 2219/2449 . . . . . Moving elements in the monolith reactor
- 2219/245 . . . . Plate-type reactors
- 2219/2451 . . . . . Geometry of the reactor
- 2219/2453 . . . . . Plates arranged in parallel
- 2219/2454 . . . . . Plates arranged concentrically
- 2219/2455 . . . . . Plates arranged radially
- 2219/2456 . . . . . Geometry of the plates
- 2219/2458 . . . . . Flat plates, i.e. plates which are not corrugated or otherwise structured, e.g. plates with cylindrical shape
- 2219/2459 . . . . . Corrugated plates
- 2219/246 . . . . . Perforated plates
- 2219/2461 . . . . . Heat exchange aspects
- 2219/2462 . . . . . the reactants being in indirect heat exchange with a non reacting heat exchange medium
- 2219/2464 . . . . . Independent temperature control in various sections of the reactor
- 2219/2465 . . . . . Two reactions in indirect heat exchange with each other
- 2219/2466 . . . . . The same reactant stream undergoing different reactions, endothermic or exothermic
- 2219/2467 . . . . . Additional heat exchange means, e.g. electric resistance heaters, coils
- 2219/2469 . . . . . Feeding means
- 2219/247 . . . . . Feeding means for the reactants
- 2219/2471 . . . . . Feeding means for the catalyst
- 2219/2472 . . . . . the catalyst being exchangeable on inserts other than plates, e.g. in bags
- 2219/2474 . . . . . Mixing means, e.g. fins or baffles attached to the plates
- 2219/2475 . . . . . Separation means, e.g. membranes inside the reactor
- 2219/2476 . . . . . Construction materials
- 2219/2477 . . . . . of the catalysts
- 2219/2479 . . . . . Catalysts coated on the surface of plates or inserts
- 2219/248 . . . . . Nanocatalysts
- 2219/2481 . . . . . Catalysts in granular form between plates
- 2219/2482 . . . . . Catalytically active foils; Plates having catalytically activity on their own
- 2219/2483 . . . . . of the plates
- 2219/2485 . . . . . Metals or alloys
- 2219/2486 . . . . . Steel
- 2219/2487 . . . . . Ceramics
- 2219/2488 . . . . . Glass
- 2219/249 . . . . . Plastics
- 2219/2491 . . . . . Other constructional details
- 2219/2492 . . . . . Assembling means
- 2219/2493 . . . . . Means for assembling plates together, e.g. sealing means, screws, bolts



- 2219/2495 . . . . . the plates being assembled interchangeably or in a disposable way
- 2219/2496 . . . . . Means for assembling modules together, e.g. casings, holders, fluidic connectors
- 2219/2497 . . . . . Size aspects, i.e. concrete sizes are being mentioned in the classified document
- 2219/2498 . . . . . Additional structures inserted in the channels, e.g. plates, catalyst holding meshes
- 2219/30 . Details relating to random packing elements
- 2219/302 . . Basic shape of the elements
- 2219/30203 . . . Saddle
- 2219/30207 . . . Sphere
- 2219/30211 . . . . Egg, ovoid or ellipse
- 2219/30215 . . . Toroid or ring
- 2219/30219 . . . Disk
- 2219/30223 . . . Cylinder
- 2219/30226 . . . Cone or truncated cone
- 2219/3023 . . . Triangle
- 2219/30234 . . . . Hexagon
- 2219/30238 . . . Tetrahedron
- 2219/30242 . . . Star
- 2219/30246 . . . Square or square-derived
- 2219/30249 . . . . Cube
- 2219/30253 . . . . Pyramid
- 2219/30257 . . . Wire
- 2219/30261 . . . . twisted
- 2219/30265 . . . . Spiral
- 2219/30269 . . . Brush
- 2219/30273 . . . Cross
- 2219/30276 . . . Sheet
- 2219/3028 . . . . stretched
- 2219/30284 . . . . twisted
- 2219/30288 . . . . folded
- 2219/30292 . . . . rolled up
- 2219/30296 . . . Other shapes
- 2219/304 . . Composition or microstructure of the elements
- 2219/30408 . . . Metal
- 2219/30416 . . . Ceramic
- 2219/30425 . . . . Carbon
- 2219/30433 . . . Glass
- 2219/30441 . . . Wood
- 2219/3045 . . . Cork
- 2219/30458 . . . Rubber
- 2219/30466 . . . Plastics
- 2219/30475 . . . comprising catalytically active material
- 2219/30483 . . . Fibrous materials
- 2219/30491 . . . Foam like materials
- 2219/308 . . filling or discharging the elements into or from packed columns
- 2219/3081 . . . Orientation of the packing elements within the column or vessel
- 2219/3083 . . . . Random or dumped packing elements
- 2219/3085 . . . . Ordered or stacked packing elements
- 2219/3086 . . . Filling of the packing elements into the column or vessel, e.g. using a tube
- 2219/3088 . . . Emptying of the packing elements from the column or vessel, e.g. using a tube
- 2219/31 . . Size details
- 2219/312 . . . Sizes
- 2219/315 . . . Two or more types of packing elements or packing elements of different sizes present in the column
- 2219/318 . . Manufacturing aspects
- 2219/3181 . . . Pleating
- 2219/3183 . . . Molding
- 2219/3185 . . . Pressing
- 2219/3186 . . . Sintering
- 2219/3188 . . . Extruding
- 2219/319 . . Mathematical modelling
- 2219/32 . Details relating to packing elements in the form of grids or built-up elements for forming a unit of module inside the apparatus for mass or heat transfer
- 2219/322 . . Basic shape of the elements
- 2219/32203 . . . Sheets
- 2219/32206 . . . . Flat sheets
- 2219/3221 . . . . Corrugated sheets
- 2219/32213 . . . . Plurality of essentially parallel sheets
- 2219/32217 . . . . . with sheets having corrugations which intersect at an angle of 90 degrees
- 2219/3222 . . . . . with sheets having corrugations which intersect at an angle different from 90 degrees
- 2219/32224 . . . . characterised by the orientation of the sheet
- 2219/32227 . . . . . Vertical orientation
- 2219/32231 . . . . . Horizontal orientation
- 2219/32234 . . . . . Inclined orientation
- 2219/32237 . . . . Sheets comprising apertures or perforations
- 2219/32241 . . . . . Louvres
- 2219/32244 . . . . . Essentially circular apertures
- 2219/32248 . . . . Sheets comprising areas that are raised or sunken from the plane of the sheet
- 2219/32251 . . . . . Dimples, bossages, protrusions
- 2219/32255 . . . . Other details of the sheets
- 2219/32258 . . . . Details relating to the extremities of the sheets, such as a change in corrugation geometry or sawtooth edges
- 2219/32262 . . . . . Dimensions or size aspects
- 2219/32265 . . . . characterised by the orientation of blocks of sheets
- 2219/32268 . . . . . relating to blocks in the same horizontal level
- 2219/32272 . . . . . relating to blocks in superimposed layers
- 2219/32275 . . . . Mounting or joining of the blocks or sheets within the column or vessel
- 2219/32279 . . . Tubes or cylinders
- 2219/32282 . . . Rods or bars
- 2219/32286 . . . Grids or lattices
- 2219/32289 . . . . Stretched materials
- 2219/32293 . . . Cubes or cubic blocks
- 2219/32296 . . . Honeycombs
- 2219/324 . . Composition or microstructure of the elements
- 2219/32408 . . . Metal
- 2219/32416 . . . . fibrous
- 2219/32425 . . . Ceramic
- 2219/32433 . . . . Carbon
- 2219/32441 . . . Glass
- 2219/3245 . . . Wood
- 2219/32458 . . . Paper
- 2219/32466 . . . comprising catalytically active material
- 2219/32475 . . . . involving heat exchange

- 2219/32483 . . . Plastics
- 2219/32491 . . . Woven or knitted materials
- 2219/326 . . . Mathematical modelling
- 2219/328 . . . Manufacturing aspects
- 2219/3281 . . . Pleating
- 2219/3282 . . . Molding
- 2219/3284 . . . Pressing
- 2219/3285 . . . Sintering
- 2219/3287 . . . Extruding
- 2219/3288 . . . Punching
- 2219/33 . . . Details relating to the packing elements in general
- 2219/3306 . . . Dimensions or size aspects
- 2219/3313 . . . Revamping
- 2219/332 . . . Details relating to the flow of the phases
- 2219/3322 . . . Co-current flow
- 2219/3325 . . . Counter-current flow
- 2219/3327 . . . Cross-current flow
- 2220/00 Aspects relating to sorbent materials**
- 2220/40 . . . Aspects relating to the composition of sorbent or filter aid materials
- 2220/42 . . . Materials comprising a mixture of inorganic materials ([materials coated or impregnated on a carrier B01J 20/32](#))
- 2220/44 . . . Materials comprising a mixture of organic materials ([materials coated or impregnated on a carrier B01J 20/32](#))
- 2220/445 . . . comprising a mixture of polymers
- 2220/46 . . . Materials comprising a mixture of inorganic and organic materials ([materials coated or impregnated on a carrier B01J 20/32](#))
- 2220/48 . . . Sorbents characterised by the starting material used for their preparation
- 2220/4806 . . . the starting material being of inorganic character
- 2220/4812 . . . the starting material being of organic character
- 2220/4818 . . . . Natural rubber
- 2220/4825 . . . . Polysaccharides or cellulose materials, e.g. starch, chitin, sawdust, wood, straw, cotton
- 2220/4831 . . . . . having been subjected to further processing, e.g. paper, cellulose pulp
- 2220/4837 . . . . . Lignin
- 2220/4843 . . . . . Algae, aquatic plants or sea vegetables, e.g. seaweeds, eelgrass
- 2220/485 . . . . . Plants or land vegetables, e.g. cereals, wheat, corn, rice, sphagnum, peat moss
- 2220/4856 . . . . . Proteins, DNA
- 2220/4862 . . . . . Feathers
- 2220/4868 . . . . . Cells, spores, bacteria
- 2220/4875 . . . the starting material being a waste, residue or of undefined composition
- 2220/4881 . . . . Residues from shells, e.g. eggshells, mollusk shells
- 2220/4887 . . . . Residues, wastes, e.g. garbage, municipal or industrial sludges, compost, animal manure; fly-ashes
- 2220/4893 . . . . Residues derived from used synthetic products, e.g. rubber from used tyres
- 2220/49 . . . Materials comprising an indicator, e.g. colour indicator, pH-indicator
- 2220/50 . . . Aspects relating to the use of sorbent or filter aid materials
- 2220/52 . . . Sorbents specially adapted for preparative chromatography
- 2220/54 . . . Sorbents specially adapted for analytical or investigative chromatography
- 2220/56 . . . Use in the form of a bed
- 2220/58 . . . Use in a single column
- 2220/60 . . . Use in several different columns
- 2220/603 . . . . serially disposed columns
- 2220/606 . . . . parallel disposed columns
- 2220/62 . . . In a cartridge
- 2220/64 . . . In a syringe, pipette, e.g. tip or in a tube, e.g. test-tube or u-shape tube ([in columns B01J 2220/58](#))
- 2220/66 . . . Other type of housings or containers not covered by [B01J 2220/58](#) - [B01J 2220/64](#)
- 2220/68 . . . Superabsorbents
- 2220/80 . . . Aspects related to sorbents specially adapted for preparative, analytical or investigative chromatography
- 2220/82 . . . Shaped bodies, e.g. monoliths, plugs, tubes, continuous beds
- 2220/825 . . . . comprising a cladding or external coating
- 2220/84 . . . Capillaries
- 2220/86 . . . Sorbents applied to inner surfaces of columns or capillaries
- 2229/00 Aspects of molecular sieve catalysts not covered by B01J 29/00**
- 2229/10 . . . After treatment, characterised by the effect to be obtained
- 2229/12 . . . to alter the outside of the crystallites, e.g. selectivation
- 2229/123 . . . . in order to deactivate outer surface
- 2229/126 . . . . in order to reduce the pore-mouth size
- 2229/14 . . . to alter the inside of the molecular sieve channels
- 2229/16 . . . to increase the Si/Al ratio; Dealumination
- 2229/18 . . . to introduce other elements into or onto the molecular sieve itself
- 2229/183 . . . . in framework positions
- 2229/186 . . . . not in framework positions
- 2229/20 . . . to introduce other elements in the catalyst composition comprising the molecular sieve, but not specially in or on the molecular sieve itself
- 2229/22 . . . to destroy the molecular sieve structure or part thereof
- 2229/24 . . . to stabilize the molecular sieve structure
- 2229/26 . . . to stabilize the total catalyst structure
- 2229/30 . . . After treatment, characterised by the means used
- 2229/32 . . . Reaction with silicon compounds, e.g. TEOS, siliconfluoride
- 2229/34 . . . Reaction with organic or organometallic compounds ([with organo-silicium compounds B01J 2229/32](#))
- 2229/36 . . . Steaming
- 2229/37 . . . Acid treatment
- 2229/38 . . . Base treatment
- 2229/40 . . . Special temperature treatment, i.e. other than just for template removal
- 2229/42 . . . Addition of matrix or binder particles
- 2229/60 . . . Synthesis on support
- 2229/62 . . . in or on other molecular sieves
- 2229/64 . . . in or on refractory materials
- 2229/66 . . . on metal supports

**2231/00 Catalytic reactions performed with catalysts classified in [B01J 31/00](#)**
**NOTE**

In this group indexing is done according to the specific catalytic reaction. In case of multiple catalytic activities only those are indexed which are specifically exemplified, i.e. by ways of worked examples, specific claims or explicit alternatives therein.

- 2231/005 . General concepts, e.g. reviews, relating to methods of using catalyst systems, the concept being defined by a common method or theory, e.g. microwave heating or multiple stereoselectivity
- 2231/10 . Polymerisation reactions involving at least dual use catalysts, e.g. for both oligomerisation and polymerisation
- 2231/12 . . Olefin polymerisation or copolymerisation
- 2231/122 . . . Cationic (co)polymerisation, e.g. single-site or Ziegler-Natta type
- 2231/125 . . . Radical (co)polymerisation, e.g. mediators therefor
- 2231/127 . . . Anionic (co)polymerisation
- 2231/14 . . Other (co) polymerisation, e.g. of lactides, epoxides ("ROMP", i.e. ring-opening metathesis polymerisation [B01J 2231/54](#))
- 2231/20 . Olefin oligomerisation or telomerisation
- 2231/30 . Addition reactions at carbon centres, i.e. to either C-C or C-X multiple bonds
- 2231/32 . . Addition reactions to C=C or C-C triple bonds
- 2231/321 . . . Hydroformylation, metalformylation, carbonylation or hydroaminomethylation
- 2231/322 . . . Hydrocyanation
- 2231/323 . . . Hydrometalation, e.g. bor-, alumin-, silyl-, zirconation or analogous reactions like carbometalation, hydrocarbation
- 2231/324 . . . Cyclisations via conversion of C-C multiple to single or less multiple bonds, e.g. cycloadditions
- 2231/325 . . . . Cyclopropanations
- 2231/326 . . . . Diels-Alder or other [4+2] cycloadditions, e.g. hetero-analogues
- 2231/327 . . . . Dipolar cycloadditions
- 2231/328 . . . . Cycloadditions involving more than 2 components or moieties, e.g. intra-/intermolecular [2+2+2] or [2+2+1], e.g. Pauson-Khand type
- 2231/34 . . Other additions, e.g. Monsanto-type carbonylations, 1,2-C=X1,2-C=X or -C-X triple bonds, 1,4-C=C-C=X or -C-X triple bonds with X= O, S, NH/N or analogues
- 2231/341 . . . 1,2-additions, e.g. aldol or Knoevenagel condensations
- 2231/342 . . . . Aldol type reactions, i.e. nucleophilic addition of C-H acidic compounds, their R<sup>3</sup>Si- or metal complex analogues, to aldehydes or ketones
- 2231/343 . . . . . to prepare cyanhydrines, e.g. by adding HCN or TMSCN
- 2231/344 . . . . . Boronation, e.g. by adding R-B(OR)<sub>2</sub>
- 2231/345 . . . . . with organometallic complexes, e.g. by adding ZnR<sub>2</sub>
- 2231/346 . . . . Mannich type reactions, i.e. nucleophilic addition of C-H acidic compounds, their R<sup>3</sup>Si- or metal complex analogues to aldimines or ketimines
- 2231/347 . . . . . via cationic intermediates, e.g. bisphenol A type processes
- 2231/348 . . . . 1,4-additions, e.g. conjugate additions
- 2231/349 . . . . 1,2- or 1,4-additions in combination with further or prior reactions by the same catalyst, i.e. tandem or domino reactions, e.g. hydrogenation or further addition reactions
- 2231/40 . Substitution reactions at carbon centres, e.g. C-C or C-X, i.e. carbon-hetero atom, cross-coupling, C-H activation or ring-opening reactions
- 2231/42 . . Catalytic cross-coupling, i.e. connection of previously not connected C-atoms or C- and X-atoms without rearrangement
- 2231/4205 . . . . C-C cross-coupling, e.g. metal catalyzed or Friedel-Crafts type
- 2231/4211 . . . . . Suzuki-type, i.e. RY + R'B(OR)<sub>2</sub>, in which R, R' are optionally substituted alkyl, alkenyl, aryl, acyl and Y is the leaving group
- 2231/4216 . . . . . with R= alkyl
- 2231/4222 . . . . . with R'= alkyl
- 2231/4227 . . . . . with Y= Cl
- 2231/4233 . . . . . Kumada-type, i.e. RY + R'MgZ, in which R is optionally substituted alkyl, alkenyl, aryl, Y is the leaving group and Z is halide
- 2231/4238 . . . . . Negishi-type, i.e. RY + R'ZnZ, in which R, R' is optionally substituted alkyl, alkenyl, alkynyl, aryl, Y is the leaving group and Z is halide or R'
- 2231/4244 . . . . . with R= alkyl
- 2231/425 . . . . . with R'= alkyl
- 2231/4255 . . . . . Stille-type, i.e. RY + R'<sup>3</sup>SnR'', in which R is alkenyl, aryl, R' is alkyl and R'' is alkenyl or aryl
- 2231/4261 . . . . . Heck-type, i.e. RY + C=C, in which R is aryl
- 2231/4266 . . . . . Sonogashira-type, i.e. RY + HC-CR' triple bonds, in which R=aryl, alkenyl, alkyl and R'=H, alkyl or aryl
- 2231/4272 . . . . . via enolates or aza-analogues, added as such or made in-situ, e.g. ArY + R<sub>2</sub>C=C(OM)Z -> ArR<sub>2</sub>C-C(O)Z, in which R is H or alkyl, M is Na, K or SiMe<sub>3</sub>, Y is the leaving group, Z is Ar or OR' and R' is alkyl
- 2231/4277 . . . . C-X Cross-coupling, e.g. nucleophilic aromatic amination, alkoxylation or analogues
- 2231/4283 . . . . . using N nucleophiles, e.g. Buchwald-Hartwig amination
- 2231/4288 . . . . . using O nucleophiles, e.g. alcohols, carboxylates, esters
- 2231/4294 . . . . . using S nucleophiles, e.g. thiols
- 2231/44 . . Allylic alkylation, amination, alkoxylation or analogues
- 2231/46 . . C-H or C-C activation
- 2231/48 . . Ring-opening reactions
- 2231/482 . . . asymmetric reactions, e.g. kinetic resolution of racemates
- 2231/485 . . . . kinetic resolution of epoxide racemates
- 2231/487 . . . . . by hydrolysis
- 2231/49 . . Esterification or transesterification
- 2231/50 . . Redistribution or isomerisation reactions of C-C, C=C or C-C triple bonds

- 2231/52 . . Isomerisation reactions
- 2231/54 . . Metathesis reactions, e.g. olefin metathesis
- 2231/543 . . . alkene metathesis
- 2231/546 . . . alkyne metathesis
- 2231/60 . Reduction reactions, e.g. hydrogenation
- 2231/62 . . Reductions in general of inorganic substrates, e.g. formal hydrogenation, e.g. of N<sub>2</sub>
- 2231/625 . . . of CO<sub>2</sub>
- 2231/64 . . Reductions in general of organic substrates, e.g. hydride reductions or hydrogenations
- 2231/641 . . . Hydrogenation of organic substrates, i.e. H<sub>2</sub> or H-transfer hydrogenations, e.g. Fischer-Tropsch processes
- 2231/643 . . . . of R<sub>2</sub>C=O or R<sub>2</sub>C=NR (R= C, H)
- 2231/645 . . . . of C=C or C-C triple bonds
- 2231/646 . . . . of aromatic or heteroaromatic rings
- 2231/648 . . . . Fischer-Tropsch-type reactions
- 2231/70 . Oxidation reactions, e.g. epoxidation, (di)hydroxylation, dehydrogenation and analogues
- 2231/72 . . Epoxidation
- 2231/74 . . Aziridination
- 2231/76 . . Dehydrogenation ([transfer-dehydrogenation of CH-XH B01J 2231/641](#); [transfer-dehydrogenation of -CHRCHR- via C-H activation B01J 2231/46](#))
- 2231/763 . . . mof -CH-XH (X= O, NH/N, S) to -C=X or -C-X triple bond species
- 2231/766 . . . of -CH-CH- or -C=C- to -C=C- or -C-C- triple bond species
- 2523/00 Constitutive chemical elements of heterogeneous catalysts**
- 2523/10 . . of Group I (IA or IB) of the Periodic Table
- 2523/11 . . Lithium
- 2523/12 . . Sodium
- 2523/13 . . Potassium
- 2523/14 . . Rubidium
- 2523/15 . . Caesium
- 2523/16 . . Francium
- 2523/17 . . Copper
- 2523/18 . . Silver
- 2523/19 . . Gold
- 2523/20 . . of Group II (IIA or IIB) of the Periodic Table
- 2523/21 . . Beryllium
- 2523/22 . . Magnesium
- 2523/23 . . Calcium
- 2523/24 . . Strontium
- 2523/25 . . Barium
- 2523/26 . . Radium
- 2523/27 . . Zinc
- 2523/28 . . Cadmium
- 2523/29 . . Mercury
- 2523/30 . . of Group III (IIIA or IIIB) of the Periodic Table
- 2523/305 . . Boron
- 2523/31 . . Aluminium
- 2523/32 . . Gallium
- 2523/33 . . Indium
- 2523/34 . . Thallium
- 2523/35 . . Scandium
- 2523/36 . . Yttrium
- 2523/37 . . Lanthanides
- 2523/3706 . . . Lanthanum
- 2523/3712 . . . Cerium
- 2523/3718 . . . Praseodymium
- 2523/3725 . . . Neodymium
- 2523/3731 . . . Promethium
- 2523/3737 . . . Samarium
- 2523/3743 . . . Europium
- 2523/375 . . . Gadolinium
- 2523/3756 . . . Terbium
- 2523/3762 . . . Dysprosium
- 2523/3768 . . . Holmium
- 2523/3775 . . . Erbium
- 2523/3781 . . . Thulium
- 2523/3787 . . . Ytterbium
- 2523/3793 . . . Lutetium
- 2523/39 . . Actinides
- 2523/392 . . . Actinium
- 2523/395 . . . Thorium
- 2523/397 . . . Uranium
- 2523/40 . . of Group IV (IVA or IVB) of the Periodic Table
- 2523/41 . . Silicon
- 2523/42 . . Germanium
- 2523/43 . . Tin
- 2523/44 . . Lead
- 2523/47 . . Titanium
- 2523/48 . . Zirconium
- 2523/49 . . Hafnium
- 2523/50 . . of Group V (VA or VB) of the Periodic Table
- 2523/51 . . Phosphorus
- 2523/52 . . Arsenic
- 2523/53 . . Antimony
- 2523/54 . . Bismuth
- 2523/55 . . Vanadium
- 2523/56 . . Niobium
- 2523/57 . . Tantalum
- 2523/60 . . of Group VI (VIA or VIB) of the Periodic Table
- 2523/62 . . Sulfur
- 2523/63 . . Selenium
- 2523/64 . . Tellurium
- 2523/65 . . Polonium
- 2523/67 . . Chromium
- 2523/68 . . Molybdenum
- 2523/69 . . Tungsten
- 2523/70 . . of Group VII (VIIB) of the Periodic Table
- 2523/72 . . Manganese
- 2523/73 . . Technetium
- 2523/74 . . Rhenium
- 2523/80 . . of Group VIII of the Periodic Table
- 2523/82 . . Metals of the platinum group
- 2523/821 . . . Ruthenium
- 2523/822 . . . Rhodium
- 2523/824 . . . Palladium
- 2523/825 . . . Osmium
- 2523/827 . . . Iridium
- 2523/828 . . . Platinum
- 2523/84 . . Metals of the iron group
- 2523/842 . . . Iron
- 2523/845 . . . Cobalt
- 2523/847 . . . Nickel



**2531/00 Additional information regarding catalytic systems classified in [B01J 31/00](#)**
**NOTE**

In this group the term "Metals" refers to the central metal in the coordination complexes ( [B01J 31/16](#) - [B01J 31/24](#) ), as used for the respective catalytic reaction, excluding carboxylates (see [B01J 31/04](#) ) and other simple salts or organometallic compounds (see [B01J 31/12](#) ). As to components, only those metals or solvents are indexed which are explicitly mentioned in the claims or the worked examples. As to compositional aspects, only those are provided for in the scheme below and are intended to be indexed, which provide additional information regarding the complexes and/or ligands classified in [B01J 31/16](#) - [B01J 31/24](#); indexing codes [B01J 2531/0286](#) - [B01J 2531/0297](#) are only used if these aspects are described as essential. Indexing codes [B01J 2531/0213](#) - [B01J 2531/0277](#) characterise the complexes on the basis of bond-type (linkage-type) thereby specifying the structural geometry of the complexes, while classification entries [B01J 31/16](#) - [B01J 31/24](#) are purely compositional subdivisions. The individual metals, the compositional aspects of complexes used and the solvents are indexed for each explicit alternative, according to the guideline above

- 2531/001 . General concepts, e.g. reviews, relating to catalyst systems and methods of making them, the concept being defined by a common material or method/theory

**NOTE**

When indexing in this group, only the focus is indexed in [B01J 2531/004](#) - [B01J 2531/007](#) and only if groups with closely related members are concerned, e.g. N-heterocyclic carbenes ( [B01J 2531/004](#) ), Pd-complexes ( [B01J 2531/005](#) ), added halide ( [B01J 2531/007](#) ). Otherwise the main code [B01J 2531/002](#) is used.

2531/002 . . Materials

2531/004 . . . Ligands

2531/005 . . . Catalytic metals

2531/007 . . . Promoter-type Additives

2531/008 . . Methods or theories

2531/02 . Compositional aspects of complexes used, e.g. polynuclearity

2531/0202 . . Polynuclearity

2531/0205 . . . Bi- or polynuclear complexes, i.e. comprising two or more metal coordination centres, without metal-metal bonds, e.g. Cp(Lx)Zr-imidazole-Zr(Lx)Cp

2531/0208 . . . Bimetallic complexes, i.e. comprising one or more units of two metals, with metal-metal bonds but no all-metal (M)<sub>n</sub> rings, e.g. Cr<sub>2</sub>(OAc)<sub>4</sub>

2531/0211 . . . Metal clusters, i.e. complexes comprising 3 to about 1000 metal atoms with metal-metal bonds to provide one or more all-metal (M)<sub>n</sub> rings, e.g. Rh<sub>4</sub>(CO)<sub>12</sub>

2531/0213 . . Complexes without C-metal linkages

2531/0216 . . . Bi- or polynuclear complexes, i.e. comprising two or more metal coordination centres, without metal-metal bonds, e.g. Cp(Lx)Zr-imidazole-Zr(Lx)Cp

2531/0219 . . . Bimetallic complexes, i.e. comprising one or more units of two metals, with metal-metal bonds but no all-metal (M)<sub>n</sub> rings, e.g. Cr<sub>2</sub>(OAc)<sub>4</sub>

2531/0222 . . . Metal clusters, i.e. complexes comprising 3 to about 1000 metal atoms with metal-metal bonds to provide one or more all-metal (M)<sub>n</sub> rings, e.g. Rh<sub>4</sub>(CO)<sub>12</sub>

2531/0225 . . Complexes comprising pentahaptocyclopentadienyl analogues

2531/0227 . . . Carbollide ligands, i.e. [nido-CnB(11-n)H11] (4-n)- in which n is 1-3

2531/023 . . . Phospholyl ligands, i.e. [CnP(5-n)Rn]- in which n is 0-4 and R is H or hydrocarbyl, or analogous condensed ring systems

2531/0233 . . . Aza-Cp ligands, i.e. [CnN(5-n)Rn]- in which n is 0-4 and R is H or hydrocarbyl, or analogous condensed ring systems

2531/0236 . . . Azaborolyl ligands, e.g. 1,2-azaborolyl

2531/0238 . . Complexes comprising multidentate ligands, i.e. more than 2 ionic or coordinative bonds from the central metal to the ligand, the latter having at least two donor atoms, e.g. N, O, S, P

2531/0241 . . . Rigid ligands, e.g. extended sp<sup>2</sup>-carbon frameworks or geminal di- or trisubstitution

2531/0244 . . . . Pincer-type complexes, i.e. consisting of a tridentate skeleton bound to a metal, e.g. by one to three metal-carbon sigma-bonds

2531/0247 . . . . Tripodal ligands, e.g. comprising the tris(pyrazolyl)borate skeleton, "tpz", neutral analogues thereof by CH/BH exchange or anionic analogues of the latter by exchange of one of the pyrazolyl groups for an anionic complexing group such as carboxylate or -R-Cp

2531/025 . . . . Ligands with a porphyrin ring system or analogues thereof, e.g. phthalocyanines, corroles

2531/0252 . . . . Salen ligands or analogues, e.g. derived from ethylenediamine and salicylaldehyde

2531/0255 . . . . Ligands comprising the N<sub>2</sub>S<sub>2</sub> or N<sub>2</sub>P<sub>2</sub> donor atom set, e.g. diiminodithiolates or diiminodiphosphines with complete pi-conjugation between all donor centres

2531/0258 . . . Flexible ligands, e.g. mainly sp<sup>3</sup>-carbon framework as exemplified by the "tedicyp" ligand, i.e. cis-cis-cis-1,2,3,4-tetrakis(diphenylphosphinomethyl)cyclopentane

2531/0261 . . Complexes comprising ligands with non-tetrahedral chirality

2531/0263 . . . Planar chiral ligands, e.g. derived from donor-substituted paracyclophanes and metallocenes or from substituted arenes

2531/0266 . . . Axially chiral or atropisomeric ligands, e.g. bulky biaryls such as donor-substituted binaphthalenes, e.g. "BINAP" or "BINOL"

2531/0269 . . Complexes comprising ligands derived from the natural chiral pool or otherwise having a characteristic structure or geometry

2531/0272 . . . derived from carbohydrates, including tartrates, e.g. DIOP

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- 2531/0275 . . . derived from amino acids
- 2531/0277 . . . derived from fullerenes and analogues, e.g. buckybowl or Cp5Cp
- 2531/028 . . . comprising affinity tags, e.g. for recovery ([self-associating or modular catalysts B01J 2531/0291](#))
- 2531/0283 . . . . The bonding to the affinity counterpart occurring via hydrogen bonding
- 2531/0286 . . Complexes comprising ligands or other components characterized by their function
- 2531/0288 . . . Sterically demanding or shielding ligands
- 2531/0291 . . . Ligands adapted to form modular catalysts, e.g. self-associating building blocks as exemplified in the patent document EP-A-1 479 439
- 2531/0294 . . . "Non-innocent" or "non-spectator" ligands, i.e. ligands described as, or evidently, taking part in the catalytic reaction beyond merely stabilizing the central metal as spectator or ancillary ligands, e.g. by electron transfer to or from the central metal or by intra-/intermolecular chemical reactions, e.g. disulfide coupling, H-abstraction
- 2531/0297 . . . Non-coordinating anions
- 2531/10 . Complexes comprising metals of Group I (IA or IB) as the central metal
- 2531/11 . . Lithium
- 2531/12 . . Sodium
- 2531/13 . . Potassium
- 2531/14 . . Rubidium
- 2531/15 . . Caesium
- 2531/16 . . Copper
- 2531/17 . . Silver
- 2531/18 . . Gold
- 2531/20 . Complexes comprising metals of Group II (IIA or IIB) as the central metal
- 2531/21 . . Beryllium
- 2531/22 . . Magnesium
- 2531/23 . . Calcium
- 2531/24 . . Strontium
- 2531/25 . . Barium
- 2531/26 . . Zinc
- 2531/27 . . Cadmium
- 2531/28 . . Mercury
- 2531/30 . Complexes comprising metals of Group III (IIIA or IIIB) as the central metal
- 2531/31 . . Aluminium
- 2531/32 . . Gallium
- 2531/33 . . Indium
- 2531/34 . . Thallium
- 2531/35 . . Scandium
- 2531/36 . . Yttrium
- 2531/37 . . Lanthanum
- 2531/38 . . Lanthanides other than lanthanum
- 2531/39 . . Actinides
- 2531/40 . Complexes comprising metals of Group IV (IVA or IVB) as the central metal
- 2531/42 . . Tin
- 2531/44 . . Lead
- 2531/46 . . Titanium
- 2531/48 . . Zirconium
- 2531/49 . . Hafnium
- 2531/50 . Complexes comprising metals of Group V (VA or VB) as the central metal
- 2531/52 . . Antimony
- 2531/54 . . Bismuth
- 2531/56 . . Vanadium
- 2531/57 . . Niobium
- 2531/58 . . Tantalum
- 2531/60 . Complexes comprising metals of Group VI (VIA or VIB) as the central metal
- 2531/62 . . Chromium
- 2531/64 . . Molybdenum
- 2531/66 . . Tungsten
- 2531/70 . Complexes comprising metals of Group VII (VIIB) as the central metal
- 2531/72 . . Manganese
- 2531/74 . . Rhenium
- 2531/80 . Complexes comprising metals of Group VIII as the central metal
- 2531/82 . . Metals of the platinum group
- 2531/821 . . . Ruthenium
- 2531/822 . . . Rhodium
- 2531/824 . . . Palladium
- 2531/825 . . . Osmium
- 2531/827 . . . Iridium
- 2531/828 . . . Platinum
- 2531/84 . . Metals of the iron group
- 2531/842 . . . Iron
- 2531/845 . . . Cobalt
- 2531/847 . . . Nickel
- 2531/90 . Catalytic systems characterized by the solvent or solvent system used
- 2531/92 . . Supercritical solvents
- 2531/922 . . . Carbon dioxide (scCO<sub>2</sub>)
- 2531/925 . . . Supercritical water (scH<sub>2</sub>O)
- 2531/927 . . . Mixtures of ionic liquids with supercritical solvents
- 2531/94 . . Fluorinated solvents
- 2531/96 . . Water
- 2531/98 . . Phase-transfer catalysis in a mixed solvent system containing at least 2 immiscible solvents or solvent phases
- 2531/985 . . . in a water / organic solvent system
- 2540/00** **Compositional aspects of coordination complexes or ligands in catalyst systems**
- 2540/10 . Non-coordinating groups comprising only oxygen beside carbon or hydrogen
- 2540/12 . . Carboxylic acid groups
- 2540/20 . Non-coordinating groups comprising halogens
- 2540/22 . . comprising fluorine, e.g. trifluoroacetate
- 2540/225 . . . comprising perfluoroalkyl groups or moieties
- 2540/30 . Non-coordinating groups comprising sulfur
- 2540/32 . . Sulfonic acid groups or their salts
- 2540/325 . . . being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional groups
- 2540/34 . . Sulfonyl groups
- 2540/345 . . . being perfluorinated, i.e. comprising at least one perfluorinated moiety as substructure in case of polyfunctional groups
- 2540/40 . Non-coordinating groups comprising nitrogen
- 2540/42 . . Quaternary ammonium groups

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- 2540/44 . . being derivatives of carboxylic or carbonic acids, e.g. amide ( $\text{RC}(=\text{O})\text{-NR}_2$ ,  $\text{RC}(=\text{O})\text{-NR-C}(=\text{O})\text{R}$ ), nitrile, urea ( $\text{R}_2\text{N-C}(=\text{O})\text{-NR}_2$ ), guanidino ( $\text{R}_2\text{N-C}(=\text{NR})\text{-NR}_2$ ) groups
- 2540/442 . . . Amide groups or imidato groups ( $\text{R-C}=\text{NR}(\text{OR})$ )
- 2540/444 . . . Nitrile groups
- 2540/446 . . . Urea groups
- 2540/448 . . . Guanidino groups
- 2540/50 . Non-coordinating groups comprising phosphorus
- 2540/52 . . Phosphorus acid or phosphorus acid ester groups
- 2540/522 . . . being phosphoric acid mono-, di- or triester groups ( $(\text{RO})(\text{R}'\text{O})_2\text{P}=\text{O}$ ), i.e.  $\text{R}=\text{C}$ ,  $\text{R}'=\text{C}$ ,  $\text{H}$
- 2540/525 . . . being phosphorous acid (-ester) groups ( $(\text{RO})\text{P}(\text{OR}')_2$ ) or the isomeric phosphonic acid (-ester) groups ( $\text{R}(\text{R}'\text{O})_2\text{P}=\text{O}$ ), i.e.  $\text{R}=\text{C}$ ,  $\text{R}'=\text{C}$ ,  $\text{H}$
- 2540/527 . . . being phosphonous acid (-ester) groups ( $\text{RP}(\text{OR}')_2$ ) or the isomeric phosphinic acid (-ester) groups ( $\text{R}_2(\text{R}'\text{O})\text{P}=\text{O}$ ), i.e.  $\text{R}=\text{C}$ ,  $\text{R}'=\text{C}$ ,  $\text{H}$
- 2540/54 . . Quaternary phosphonium groups
- 2540/60 . Groups characterized by their function
- 2540/62 . . Activating groups
- 2540/64 . . Solubility enhancing groups
- 2540/66 . . Linker or spacer groups
- 2540/68 . . Associating groups, e.g. with a second ligand or a substrate molecule via non-covalent interactions such as hydrogen bonds