

H10H

INORGANIC LIGHT-EMITTING SEMICONDUCTOR DEVICES HAVING POTENTIAL BARRIERS

Definition statement

This place covers:

Inorganic semiconductor devices having potential barriers which emit light when current is passed through them.

This includes the following kinds of devices:

- light-emitting diodes [LED]; and
- superluminescent diodes [SLD].

In this subclass, the light-emitting semiconductor devices may emit visible, infrared [IR] or ultraviolet [UV] light.

This place also covers processes and apparatus specially adapted for the manufacture or treatment of such devices.

In this subclass, the periodic system used is the I to VIII group system indicated in the Periodic Table under Note (3) of section [C](#).

References

Limiting references

This place does not cover:

Semiconductor lasers	H01S 5/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Electroluminescent light sources per se	H05B 33/00
Circuit arrangements for operating LEDs	H05B 45/00
Light-emitting devices with organic active regions, e.g. OLEDs	H10K 50/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

bipolar	refers to semiconductor technology that involves multi-carrier-type operation, i.e. which simultaneously uses both electrons and holes as charge carriers
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body	the region of semiconductor (resp. solid-state) material(s) within which, or at the surface of which, the physical effects that are characteristic of the device occur, and any bordering semiconductor (resp. solid-state) material(s) that are contiguous with this region. Examples: in a field-effect transistor [FET], the physical effects occur in the channel region between the source and the drain. The semiconductor body includes the channel region, the source and drain regions, and any contiguous semiconductor material; in a light-emitting diode [LED], the physical effects occur at a junction of active semiconductor layers. The semiconductor body includes these active semiconductor layers and any contiguous semiconductor layers, such as buffer layers, possibly a growth substrate, etc., that are between the cathode and anode electrodes; in a thermoelectric device, the solid-state body includes all solid-state materials in the path of current between the electrodes.
chip	a piece of a wafer or a substrate that has been processed to contain devices therein or thereon. The expression "diced chip" refers to the result of dicing a wafer or a substrate into a plurality of chips, whereas "undiced chip" refers to a chip before dicing or with no dicing.
component	an electric circuit element (e.g. diode, transistor, LED, etc.) that is one of a plurality of elements formed in or on a common substrate, e.g. in an integrated device
container	a solid construction in which (one or more) devices are placed, or which is formed around the devices, for forming packaged devices. A container requires a partial or total enclosure and it may also comprise a filling.
device	an electric circuit element (e.g. diode, transistor, LED, etc.); (depending on the context) can also refer to an integrated device (e.g. CMOS-IC, DRAM device, etc.). A device may be in the form of a bare or packaged chip.
dopant	the atoms or compounds added to a material during doping
doping	the intentional addition of a small quantity of atoms or compounds into a material to achieve a desired characteristic, e.g. to produce an n-type or p-type material
electrode	a conductive region in or on the semiconductor body or solid-state body of a device (and other than the body itself) which exerts an electrical influence on the body, irrespective of whether or not an external electrical connection is made thereto. The term covers metallic regions which exert electrical influence on the body through an insulating region (e.g. in intentional non-parasitic capacitive coupling), or inductive coupling arrangements. In a capacitive coupling arrangement, the dielectric region is regarded as part of the electrode. The overall conductive wiring may comprise multiple portions. In such a case, only the wiring portions that exert an electrical influence on the body are considered portions of the electrode. Examples: conductive layer(s) in direct physical contact with the body; conductive region(s) exerting an inductive coupling onto the body; a multilayer structure which exerts influence on the body through an insulating region, e.g. in intentional non-parasitic capacitive coupling.

encapsulation	an enclosure consisting of (one or more) layers, e.g. comprising organic polymers, which at least partially enclose the (one or more) devices, thereby protecting them. An encapsulation is often used to hermetically seal devices.
FET	field-effect transistor
field-effect	refers to semiconductor technology wherein a voltage applied to a gate electrode creates an electric field that allows for control of current near the interface of the gate and the body, e.g. to create an inversion channel between the source and drain of a MOSFET
individual	refers to: an electric circuit element not being an integrated device; or a component of an integrated device. Examples of individual devices include: diodes, transistors, photovoltaic cells, Josephson-junction devices, light-emitting diodes [LED], organic LEDs, or a single LED component within an integrated device.
integrated circuit	an integrated device where all the electric circuit elements (e.g. diodes, transistors, LEDs, etc.) are formed in or on a common substrate, including interconnections between the elements
integrated device	a device consisting of a plurality of semiconductor or other solid-state electric circuit elements formed in or on a common substrate
interconnection	a conductive arrangement for conducting electric current from an electrode of a circuit element to another part of the circuit. Examples include metal wirings.
MIS	metal-insulator-semiconductor
MISFET	metal-insulator-semiconductor field-effect transistor
MOS	metal-oxide-semiconductor
package	the collection of all elements, which are external to the chip, that protect the chip or connect it to another object. Package, therefore, covers encapsulations, containers, package substrates, interposers, heatsinks or the like. Package does not include objects at a higher system level, like circuit boards and beyond, e.g. a housing in which the circuit board is enclosed.
TFT	thin-film transistor
unipolar	refers to semiconductor technology that primarily involves one type only of charge carrier, i.e. it involves either holes or electrons but not both
wafer	It can be one of the following: (a) a slice of semiconductor or electric solid-state active material. For example: a slice of silicon; a slice of a semiconducting compound, e.g. gallium nitride [GaN]; a slice of lithium tantalate [LiTaO ₃] for superconductor applications. (b) a multilayered laminate, having at least one layer of semiconductor or electric solid-state active material, the layer being meant to be processed into devices. For example: silicon-on-insulator [SOI]; silicon-on-glass [SOG]; silicon-on-sapphire [SOS]; a composite wafer comprising silicon carbide [SiC] on polycrystalline silicon [Si] support; a layer of semiconducting nanowires on glass. A wafer is typically processed by (e.g.) deposition, etching, doping or diffusion, and is then typically diced into chips.

H10H 20/01

Manufacture or treatment

Definition statement

This place covers:

Processes and apparatus specially adapted for the manufacture or treatment of individual light-emitting semiconductor devices covered by main group [H10H 20/00](#).

H10H 20/80

Constructional details

Definition statement

This place covers:

Constructional details of individual light-emitting semiconductor devices covered by main group [H10H 20/00](#). Classification is made in this group if the invention lies in the details of the constructional parts per se, e.g. electrodes, bodies, coatings, etc.

Relationships with other classification places

Group [H10H 20/80](#) covers constructional details for individual light-emitting devices. When the constructional detail is relevant to integrated devices or assemblies comprising multiple devices, then classification is made in group [H10H 29/80](#).

H10H 20/81

Bodies

Definition statement

This place covers:

Semiconductor bodies characterised by aspects including:

- the nature of the material (e.g. specific composition, special doping species, crystal structure or orientation); or
- the shape or geometry of the bodies.

H10H 20/811

having quantum effect structures or superlattices, e.g. tunnel junctions

Definition statement

This place covers:

- Semiconductor bodies having quantum effect structures, e.g. tunnelling barriers or quantum wells;
- Semiconductor bodies having superlattices, e.g. delta-doped superlattices.

H10H 20/813

having a plurality of light-emitting regions, e.g. multi-junction LEDs or light-emitting devices having photoluminescent regions within the bodies

Definition statement

This place covers:

Semiconductor bodies having two or more light-emitting regions wherein the light-emitting regions are not individually addressable.

Examples include semiconductor bodies having:

- discontinuous light-emitting layers;
- plural light-emitting layers between a single pair of electrodes.

H10H 20/816

having carrier transport control structures, e.g. highly-doped semiconductor layers or current-blocking structures

Definition statement

This place covers:

Semiconductor bodies having regions, structures or layers that modify the carrier path, or impede or enhance carrier mobility, e.g. carrier transport, blocking or injection layers.

H10H 20/819

characterised by their shape, e.g. curved or truncated substrates

Definition statement

This place covers:

Semiconductor bodies characterised by the shape of their semiconductor bodies, e.g. curved or truncated semiconductor substrates, periodic interfaces or nanostructures.

H10H 20/831

characterised by their shape

Definition statement

This place covers:

Electrodes characterised by their shape. This characterisation may relate to the shape of an individual electrode or the relative shapes of the anode and cathode electrodes.

H10H 20/85**Packages****Relationships with other classification places**

Group [H10H 20/85](#) covers packaging elements for individual emitting devices. When the packaging element is relevant to integrated devices or assemblies of multiple devices, then classification is made in group [H10H 29/85](#).

H10H 20/851**Wavelength conversion means****Definition statement**

This place covers:

Elements formed in light-emitting device packages, meant for converting a wavelength emitted by the devices into a different wavelength. The elements may comprise a matrix material, e.g. a binder material, into which wavelength conversion materials, e.g. phosphorescent or fluorescent materials, are dispersed.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Luminescent materials per se	C09K 11/00
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H10H 20/854**characterised by their material, e.g. epoxy or silicone resins****References****Informative references**

Attention is drawn to the following places, which may be of interest for search:

Compositions of organic macromolecular compounds	C08L
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H10H 20/855**Optical field-shaping means, e.g. lenses****Definition statement**

This place covers:

Elements formed in light-emitting device packages that are specially adapted for altering the shape of the optical field of the light emitted from the light emitting device.

Examples include lenses, refractors, diffraction gratings, matrix including scattering particles.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Light sources using semiconductor devices as light-generating elements	F21K 9/00
Lens shaped refractors for light sources	F21V 5/04
Optical elements, systems or apparatus	G02B
Arrangements for extracting light from organic light-emitting devices	H10K 50/85
Arrangements for improving contrast in organic light-emitting devices	H10K 50/86

H10H 20/856**Reflecting means****References****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Reflective means for organic light-emitting devices	H10K 50/856
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H10H 20/857**Interconnections, e.g. lead-frames, bond wires or solder balls****References****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Interconnections generically applicable to semiconductor devices	H01L 23/48 ; H01L 23/52
Lead-frames generically applicable to semiconductor devices	H01L 23/495

H10H 20/858**Means for heat extraction or cooling****References****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Means for heat extraction or cooling generically applicable to semiconductor devices	H01L 23/34
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H10H 29/10**Integrated devices comprising at least one light-emitting semiconductor component covered by group [H10H 20/00](#) (active-matrix LED displays [H10H 29/30](#))****References****Limiting references***This place does not cover:*

Active-matrix LED displays	H10H 29/30
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H10H 29/20

Assemblies of multiple devices comprising at least one light-emitting semiconductor device covered by group [H10H 20/00](#) (active-matrix LED displays [H10H 29/30](#))

References

Limiting references

This place does not cover:

Active-matrix LED displays	H10H 29/30
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H10H 29/30

Active-matrix LED displays

Definition statement

This place covers:

LED displays wherein the LEDs are arranged into subpixels of different colours (i.e. full-colour LED displays) or into pixels of the same colour (i.e. monochromatic LED displays) and the pixels or subpixels are individually driven by the active-matrix circuitry.

For classification of active-matrix LED displays here, the emphasis of the invention must concern the LEDs, the layers closely related to the LEDs or constructional details closely related to the LEDs, e.g. interconnections between the LEDs or their encapsulations.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control arrangements or circuits for semiconductor display panels, e.g. using light emitting diodes [LED]	G09G 3/32
Active-matrix OLED displays	H10K 59/12

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

pixel	unit of a display device, the unit often having an arrangement of subpixels, e.g. an RGB pixel comprising red (R), blue (B) and green (G) subpixels, and the unit typically repeating across the display
subpixel	portion of a pixel capable of emitting light of a particular colour, typically red (R), blue (B) or green (G), and separately addressable from the other subpixels of the pixel. The subpixel includes one or more light-emitting elements, each being connected to addressing circuitry, e.g. a driving transistor.

H10H 29/37

Pixel-defining structures, e.g. banks between the LEDs

Definition statement

This place covers:

The layer or layers of an active-matrix display that define the region in which the light-emitting devices are disposed and physically separates the light-emitting devices in one subpixel from the light-emitting devices in other subpixels, or the light-emitting devices in one pixel from the light-emitting devices in other pixels.

H10H 29/49

Interconnections, e.g. wiring lines or terminals (connection of the pixel electrodes to the driving transistors [H10H 29/39](#))

Relationships with other classification places

Interconnection structure of active-matrix LED displays is generally covered in group [H10H 29/49](#) whereas interconnections of these displays as they relate to control is covered in group [G09G 3/32](#). Specifically, group [G09G 3/32](#) covers:

- arrangements or circuits for processing control signals to achieve the display image;
- solutions of problems of displays by means of their control; and
- improvements of the control of displays.