

**THIS OPINION WAS NOT WRITTEN FOR PUBLICATION**

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 16

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte CARL RALEIGH and WILLIAM C. ROMAN

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Appeal No. 1997-3390  
Application No. 08/354,384

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ON BRIEF

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Before JERRY SMITH, FLEMING, and HECKER, Administrative Patent Judges.

FLEMING, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the rejection of claims 8 through 20. Claims 1 through 7 have been canceled.

Appellants' invention is generally directed to a method of forming metal layers for attachment to a heat sink in semiconductor devices and in particular, to flame spraying a heat spreading layer on the back surface of a semiconductor die. As disclosed on page 5 of the specification and Figure

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2, molybdenum or tungsten layer 18, having a thermal coefficient of expansion similar to that of semiconductor wafer, is flame sprayed onto the back side of semiconductor die 12. Appellants further disclose that metal layer 15 may be optionally deposited on the back surface of the die before depositing the heat spreading layer for improved adhesion or contact resistance. The step of flame spraying which is performed in less than a minute at a temperature below 200EC, as disclosed on page 6 of the specification, minimizes damage to the active regions with electrical properties that can be adversely affected by extended exposure to high temperature. Additionally, Appellants disclose on page 6 of the specification that the semiconductor die with the flame sprayed metallization layer is attached to a metal substrate using low melting point solders.

Representative independent claim 8 is reproduced as follows:

8. A method for fabricating a semiconductor device with a flame sprayed heat spreading layer comprising the steps of:  
    providing a semiconductor die having a thermal coefficient of expansion and a back surface;  
    providing a material having a thermal coefficient of expansion similar to the

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thermal coefficient of expansion of the  
semiconductor die; and  
flame spraying a heat spreading layer of  
the material on the back surface of the  
semiconductor die.

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The Examiner relies on the following references:

Santangelo et al. (Santangelo) 1994	5,342,793	Aug. 30,
Merz et al. (Merz) 1991	5,032,469	Jul. 16,

Claims 8 through 20 stand rejected under 35 U.S.C. § 103 as being obvious over Santangelo and Merz.

Rather than repeat the arguments of Appellants and the Examiner, reference is made to the brief and the answer for the details thereof.

#### OPINION

After careful review of the evidence before us, we do not agree with the Examiner that claims 8 through 20 are properly rejected under 35 U.S.C. § 103. Accordingly, we reverse.

The Examiner has failed to set forth a prima facie case. It is the burden of the Examiner to establish why one having ordinary skill in the art would have been led to the claimed invention by the express teachings or suggestions found in the prior art, or by implications contained in such teachings or suggestions. In re Sernaker, 702 F.2d 989, 995, 217 USPQ 1, 6 (Fed. Cir. 1983). "Additionally, when determining obviousness, the claimed invention should be considered as a whole; there is no legally recognizable 'heart' of the

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invention." Para-Ordnance Mfg. v. SGS Importers Int'l, Inc.,  
73 F.3d 1085, 1087, 37 USPQ2d 1237, 1239 (Fed. Cir. 1995),  
cert. denied, 519 U.S. 822 (1996) citing W.L. Gore & Assoc.,  
Inc. v. Garlock, Inc., 721 F.2d 1540, 1548, 220 USPQ 303, 309  
(Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Appellants on page 5 of the brief argue that Santangelo teaches merely a method for low pressure deposition of metal layers on the back of a semiconductor substrate while Merz discloses flame spraying for coating metal substrates such as steel and copper. Appellants add that Merz does not provide any suggestion to use flame spraying for forming a metal layer on a semiconductor substrate. Additionally, Appellants on page 6 of the brief point out that bead or grit blasting of the substrate prior to flame spraying, as taught by Merz, destroys the surface of the semiconductor substrate of Santangelo. Appellants conclude that combining Merz with Santangelo is neither possible nor suggested by any of the references.

The Examiner on pages 4 and 5 of the answer responds to Appellants' arguments by stating that the reason to combine is taught by Merz in column 3, lines 53 and 54 that any suitable

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substrate to which the coating will adhere can be used. The Examiner further states that the references are combinable since the step of bead or grit blasting to roughen the surface is optional and may be omitted. The Examiner adds that Santangelo teaches coating of a semiconductor substrate which may be combined with the plasma spraying process of Merz since both processes are performed at low temperatures and will not affect the substrate.

The Federal Circuit states that "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Fritch, 972 F.2d 1260, 1266 n.14, 23 USPQ2d 1780, 1783-84 n.14 (Fed. Cir. 1992), citing In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). It is further established that "[s]uch a suggestion may come from the nature of the problem to be solved, leading inventors to look to references relating to possible solutions to that problem." Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed. Cir. 1996), citing In re Rinehart, 531 F.2d 1048, 1054, 189 USPQ 143, 149 (CCPA

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1976) (considering the problem to be solved in a determination of obviousness). The Federal Circuit reasons in Para-Ordnance Mfg. Inc. v. SGS Importers Int'l Inc., 73 F.3d 1085, 1088-89, 37 USPQ2d 1237, 1239-40 (Fed. Cir. 1995), cert. denied, 519 U.S. 822 (1996), that for the determination of obviousness, the court must answer whether one of ordinary skill in the art who sets out to solve the problem and who had before him in his workshop the prior art, would have been reasonably expected to use the solution that is claimed by the Appellants.

We find that Santangelo is concerned with forming a metal layer on the back surface of a semiconductor substrate for improved adhesion to a heat sink as well as low contact resistance. Santangelo specifically teaches in column 2, lines 33 through 63 that an ion implantation step provides the low resistance contact as the deposition of one or more metal layers allow the back surface of the semiconductor substrate be soldered to a metal substrate. We further find that Santangelo refers generally to "depositing" metal layers and does not specify a particular deposition method such as Appellants' flame spraying method. Turning to Merz, we find

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that a method of plasma spraying over metal substrates such as steel or copper is disclosed. Merz teaches examples of different applications for plasma sprayed metallization in column 1, lines 14 through 25, as blades and other components in turbines or chemical reaction vessels and pipes. Merz further teaches in column 3, lines 62 through 65, that the substrate may be preferably treated by bead or grit blasting to roughen the surface and provide a strong adhesion. We note that Merz provides several tables showing results of coating process for different substrate samples which are specified as either steel or copper.

We do not agree with the Examiner that Merz' flame spraying metallization method may be used with the semiconductor substrate of Santangelo, as recited in Appellants' claim 8, to avoid adverse effects on the substrate. Merz is concerned with coating metal substrates such as steel and copper to avoid corrosion in adverse environments. However, Merz is silent with regard to flame spraying as a low temperature coating that prevents adverse effects on other substrate materials such as semiconductors. Therefore, we find no reason for combining the coating process

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of Merz with Santangelo's semiconductor substrate in view of the different substrate materials or the preparation steps as suggested by Merz. In particular, Merz in column 2, lines 42 through 47, specifies the feed powder as an alloy of stainless steel and a refractory metal. Additionally, in column 3, lines 62 through 65, Merz provides the preferred blasting step that roughens and improves the surface adhesion of a metal substrate such as steel and copper but does little for a semiconductor substrate other than damaging its surface. Neither the specific feed powder material nor the surface preparation step would teach to one of ordinary skill in the art to combine the processing steps of Merz with a semiconductor substrate. We do not agree with the Examiner that any substrate may simply be used for flame spraying as Merz in column 3, lines 53 through 62, teaches that "[a]ny suitable substrate" is preferably "metallic" or materials such as "copper and steel." Merz further provides examples of industrial grade steel that require different surface treatment and coating process than a semiconductor substrate as recited in Appellants' independent claim 8.

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In view of the analysis above, we find no reason or suggestion for combining Santangelo and Merz. We further find that one of ordinary skill in the art would not have reasonably used a process of flame sprayed metallization for metal substrates as taught by Merz for forming a metal layer on back of a semiconductor substrate as disclosed by Santangelo. We note that the other independent claim 15 recites the step of flame spraying a metal layer on the back surface of a semiconductor wafer similar to claim 8. Accordingly, we reverse the rejection of claims 8 through 20 under 35 U.S.C. § 103 over Santangelo and Merz.

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In view of the foregoing, the decision of the Examiner  
rejecting claims 8 through 20 under 35 U.S.C. § 103 is  
reversed.

**REVERSED**

JERRY SMITH	)	
Administrative Patent Judge	)	)
	)	
	)	
	)	BOARD OF PATENT
MICHAEL R. FLEMING	)	
Administrative Patent Judge	)	APPEALS AND
	)	
	)	INTERFERENCES
	)	
STUART S. HECKER	)	
Administrative Patent Judge	)	

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