

The opinion in support of the decision being entered today was *not* written for publication and is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ROBERT A. NEWMAN
and JAIME D. WEIDLER

Appeal 2007-1363
Application 10/637,419
Technology Center 2800

Decided: May 15, 2007

Before CHARLES F. WARREN, THOMAS A. WALTZ, and
PETER F. KRATZ, *Administrative Patent Judges*.

WALTZ, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Primary Examiner's final rejection of claims 1-5, 7-10, and 21-31, which are the only claims pending in this application. We have jurisdiction pursuant to 35 U.S.C. § 6.

According to Appellants, the invention is directed to a method of reducing shear stress in a packaged semiconductor chip, including the steps of providing a semiconductor chip package base having a die attachment area, providing a die, providing a die attach material, controlling an amount of the die attach material whereby at least one portion of the die attach material forms a meniscus on at least one side of the die, with the at least one meniscus forming at least one die attach fillet upon curing, and the height of the at least one die attach fillet is thereby controlled to reduce the shear stress in the die (Br. 2-3). Further details of the invention may be found in illustrative independent claim 1 which is reproduced below:

1. A method of reducing shear stress in a packaged semiconductor chip, comprising the steps of:

providing a semiconductor chip package base having a die attachment area;

providing a die having at least one side and at least one edge,

said die comprising a semiconductor material selected from a group consisting essentially of silicon (Si), germanium (Ge), and gallium arsenide (GaAs), and

each said at least one side having a thickness and a width;

providing a die attach material;

controlling an amount of said die attach material disposed between said die and said semiconductor chip package base,

whereby at least one portion of said die attach material forms at least one meniscus on said at least one side of the die,

whereby said at least one meniscus forms at least one die attach fillet upon curing of said die attach material,

thereby controlling at least one height of said at least one die attach fillet, and thereby reducing shear stress in said die, said at least one controlled height comprising a range of approximately 0% to approximately 75% of said at least one die side thickness at a location of at least 25% inboard from each said at least one edge of any given at least one die side, and

completing packaging of said semiconductor chip.

The Examiner has relied on the following reference as evidence of unpatentability:

Raiser US 6,365,441 B1 Apr. 2, 2002

ISSUES ON APPEAL

Claims 1, 3-5, 7-10, 21, and 23-31 stand rejected under 35 U.S.C. § 102(e) as anticipated by Raiser (Answer 3).

Claims 2 and 22 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Raiser (Answer 5).

Appellants contend that Raiser does not teach, disclose, or suggest controlling an amount of die attach material disposed between a die and a semiconductor chip package base, thereby controlling at least one height of at least one fillet, and thus reducing the shear stress in the die (Br. 10).

Appellants contend that Raiser fails to impose any requirements on the height of fillet 38 and merely exemplifies that fillet 38 may extend from substrate 14 to a point approximately one-half the thickness of integrated circuit 12 (Br. 11). Thus Appellants contend that Raiser fails to disclose any

relationship between the amount of underfill material that is applied between integrated circuit 12 and substrate 14 and the height of fillet 38 (*id.*).

Appellants contend that Raiser discloses that the strain and corresponding stress for the outermost solder bumps is not reduced by increasing the percentage of underfill beyond approximately 25% (Br. 12). Appellants also contend that the underfill material 26 is used by Raiser to provide support to solder bumps 16, thus the underfill material does not “attach” circuit 12 to substrate 14 and is not “die attach material” as specified in claim 1 on appeal (*id.*).¹

The Examiner contends that Raiser clearly discloses that the fillet 38 of the die attach material 38/26 formed along the perimeter of integrated circuit 12 extends from the substrate 14 to a point approximately one-half (or 50%) of the thickness (i.e., height) of integrated circuit 12 (Answer 3 and 6).

The Examiner contends that the underfill material 26 disclosed by Raiser is a “die attach material” within the scope of the claims since this liquid epoxy material contacts both the die 12 and the substrate 14 (Answer 9). The Examiner also contends that the underfill material 26 disclosed by Raiser is used to reduce the shear strain and corresponding shear stress in solder bumps 16, thus correspondingly reducing the shear stress in die 12 (Answer 8).

¹ Appellants only present specific, substantive arguments with respect to claim 1 on appeal (Br. 9-13). These arguments are merely repeated for claims 21 and 23-31 (Br. 13-17). Thus, we limit our consideration for this ground of rejection in the appeal to claims 1 and 21.

Accordingly, the issues presented in the record of this appeal are as follows: (1) does Raiser disclose a height of at least one die attach fillet that is in the range of approximately 0% to approximately 75% of said at least one die side thickness at a location of at least 25% inboard as required by claim 1 on appeal (or within the range of 33% to 75% as required by claim 21 on appeal)? ; and (2) is the underfill material 26 disclosed by Raiser “die attach material” within the scope of claim 1 on appeal?

We determine that the Examiner has established a prima facie case of anticipation in view of the disclosure of Raiser, which prima facie case has not been adequately rebutted by Appellants’ arguments. Therefore, we AFFIRM the rejection based on § 102(e) over Raiser for the reasons stated in the Answer, as well as those reasons set forth below. We also determine that the Examiner has established a prima facie case of obviousness in view of Raiser. Since Appellants present the same arguments for the § 103(a) rejection over Raiser as presented for the § 102(e) rejection (Br. 17), we AFFIRM this rejection for the same reasons as discussed below and in the Answer.

OPINION

A. The Rejection under § 102(e)

We determine the following factual findings from the record in this appeal:

- (1) Raiser discloses a semiconductor chip package base or substrate 14 having a die attachment area between the substrate and the integrated circuit 12 (silicon die) which has at least one side and at least one edge where an amount of die attach material (underfill) 38/26 is provided to result in at least one portion of the die attach

material (underfill) forming a meniscus on at least one side of integrated circuit 12 (col. 1, ll. 12-13; col. 2, ll. 17-45; Figure 1; and the Answer 3-4);

- (2) Raiser discloses that the liquid die attach material 26 is cured to a solid state and forms a fillet 38 along the entire perimeter of the integrated circuit 12, exemplifying fillet 38 extending from the substrate 14 to a point “approximately one-half” the thickness of the integrated circuit 12 (col. 1, ll. 39-40; col. 2, ll. 45-50; col. 3, ll. 48-54; and the Answer 4);
- (3) Raiser teaches that, in one embodiment, underfill material may extend from an outer edge of the integrated circuit 12 towards the center of the integrated circuit a length L_1 that is no less than approximately 25% of a length L_2 between the edges and the center of the integrated circuit (col. 1, ll. 54-60; col. 2, ll. 59-63; col. 3, ll. 24-29; Figure 2; and the Answer 4); and
- (4) Raiser teaches that when the package is thermally cycled a mechanical strain may create cracks in the solder bumps 16, and the use of underfill material 38/26 structurally reinforces the solder bumps, reducing the strain on the solder bumps 16 and the corresponding stress, resulting in an improved life and reliability of the package (col. 1, ll. 27-40; col. 2, ll. 38-40; col. 3, ll. 24-44; Figures 3a-c; Figures 4a-c; and the Answer 8).

During prosecution before the Examiner, we construe the language of the claims by the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account any enlightenment or definitions found in the specification. *See*

In re Morris, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997). A disclosure in the prior art of any value within the claimed range constitutes anticipation of that claimed range. *See In re Wertheim*, 541 F.2d 257, 267, 191 USPQ 90, 100 (CCPA 1976).

Applying the preceding legal principles to the factual findings in the record of this appeal, we determine that the Examiner has established a *prima facie* case of anticipation which has not been adequately rebutted by Appellants' arguments. First, we construe the claimed term "die attach material" (*see* claim 1 on appeal). We note that there is no clear definition of this term in Appellants' Specification, nor have Appellants pointed to any definition or art-recognized meaning for this term (*see* the Brief in its entirety). However, from the context of Appellants' Specification and Figures, we construe the term "die attach material" by its broadest reasonable meaning to include any material which fills at least a portion of the space between the die and the chip base or substrate and functions to attach or hold the die and chip base together (Specification, ¶ [0002], ¶ [0003], ¶ [0044], and Figures 1-15).

In view of our claim construction above, we determine that the underfill 26 and fillet 38 disclosed by Raiser clearly constitute "die attach material" within the meaning of this claimed term. We determine that Raiser teaches that underfill material 26 fills at least a portion of the space between the integrated circuit 12 (die) and the substrate 14 (chip base) and functions to hold these two components together (Raiser, col. 2, ll. 36-38, 51-54; col. 3, ll. 48-51; and the Answer 9).

As shown by factual findings (1) through (3) listed above, we determine that Raiser describes an example which falls within the scope of

claims 1 and 21 on appeal (“approximately one-half” falls within the claimed ranges of “approximately 0% to approximately 75%” and “approximately 33% to approximately 75%”). The argument that Raiser fails to disclose or teach any “relationship” between the amount of underfill material 26 and the height of fillet 38 (Br. 11) is irrelevant since Raiser describes an example which falls within the claimed range.

For the foregoing reasons and those stated in the Brief, we affirm the rejection of claims 1, 3-5, 7-10, 21, and 23-31 under § 102(e) over Raiser.

B. The Rejection over § 103(a)

As previously noted, Appellants do not present any additional reasons for the patentability of claims 2 and 22 (Br. 17). Therefore, we adopt the factual findings and conclusion of law as stated by the Examiner (Answer 5 and 14). We additionally note the law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. These cases have consistently held that in such a situation Appellants must show that the particular variable is critical, which in this appeal Appellants have not done. *See In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

C. Other Issues

In the event of further or continuing prosecution of the claimed subject matter, the Examiner and Appellants should determine if the “related art” as disclosed in the Specification is actually “prior art” capable of supporting a rejection of the claims. We note that the “related art” in Appellants’ Specification uses a very low epoxy fillet height in the range of less than 33.33%, although examples show low values such as 25% and high values such as 90% (Specification 2:16-18; 3:23-24; and Figures 5-12

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as disclosed in ¶¶ [0015] through [0022]). If the “related art” value of 25% was indeed “prior art,” this value would anticipate the range of “approximately 0% to approximately 75%” as recited in claim 1 on appeal.

D. Time Period for Response

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv) (2006).

AFFIRMED

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