

The opinion in support of the decision being entered today was not written for publication in a law journal and is not binding precedent of the Board.

Paper No. 13

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte JAO-CHIN CHENG and MING-HSIEN CHEN

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Appeal No. 2001-1421  
Application No. 09/128,226

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ON BRIEF

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Before KRASS, RUGGIERO, and BARRY, Administrative Patent Judges.  
RUGGIERO, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on the appeal from the final rejection of claims 1-15, which are all of the claims pending in the present application.

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The claimed invention relates to an underfilling method for a flip-chip packaging process in which an underfill material layer is initially formed over bumps on a semiconductor substrate. A die sawing process is then performed to form a plurality of dies followed by a flip-chip process on each the dies to adhere the dies to another substrate. According to Appellants (specification, page 3), because the underfill material is coated from the top of the bumps before the flip-chip process, the problem of air being trapped between the die and the adhered substrate can be eliminated. In addition, Appellants assert that process time is shortened since underfill material is dispensed over all of the dies before die sawing in contrast to the conventional underfilling process in which underfill material needs to be dispensed and the edges sealed on each individual die.

Claim 1 is illustrative of the invention and reads as follows:

1. An underfilling method for a flip-chip packaging process, the method comprising:

providing a first semiconductor substrate, wherein the first semiconductor substrate has at least a plurality of pads and a passivation layer, wherein the passivation layer is formed over the substrate but exposes the pads, and wherein the passivation layer is thicker than the pads;



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OPINION

We have carefully considered the subject matter on appeal, the rejection advanced by the Examiner and the evidence of obviousness relied upon by the Examiner as support for the rejection. We have, likewise, reviewed and taken into consideration, in reaching our decision, Appellants' arguments set forth in the Briefs along with the Examiner's rationale in support of the rejections and arguments in rebuttal set forth in the Examiner's Answer.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would have suggested to one of ordinary skill in the art the invention as recited in claims 1-3, 6-11, 14, and 15. We reach the opposite conclusion with respect to the Examiner's obviousness rejection of claims 4, 5, 12, and 13. Accordingly, we affirm-in-part.

Appellants' arguments in response to the Examiner's obviousness rejection of the appealed claims are organized according to a suggested grouping of claims indicated at page 3 of the Brief. We will consider the appealed claims separately only to the extent separate arguments for patentability are presented. Any dependent claim not separately argued will stand

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or fall with its base claim. Note In re King, 801 F.2d 1324, 1325, 231 USPQ 136, 137 (Fed. Cir. 1986); In re Sernaker, 702 F.2d 989, 991, 217 USPQ 1, 3 (Fed. Cir. 1983).

With respect to independent claim 1, the representative claim for Appellants first suggested grouping (including claims 1-3, 6, 7, and 14)<sup>2</sup>, after reviewing the Examiner's analysis (Answer, pages 4 and 5), it is our view that such analysis carefully points out the teachings of the Goossen and Harper references, reasonably indicates the perceived differences between this prior art and the claimed invention, and provides reasons as to how and why the prior art teachings would have been modified and/or combined to arrive at the claimed invention. In our opinion, the Examiner's analysis is sufficiently reasonable that we find that the Examiner has at least satisfied the burden of presenting a prima facie case of obviousness. The burden is, therefore, upon Appellants to come forward with evidence and/or arguments which persuasively rebut the Examiner's prima facie case of obviousness. Only those arguments actually made by Appellants have been considered in this decision. Arguments

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<sup>2</sup> Although Appellants' grouping at page 3 of the Brief includes dependent claim 5 as part of this group, claim 5 should properly be grouped with its base claim, i.e., dependent claim 4.

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which Appellants could have made but chose not to make in the Briefs have not been considered [see 37 CFR § 1.192(a)].

With respect to representative independent claim 1, Appellants' arguments in response to the obviousness rejection initially assert that the Examiner has failed to establish a prima facie case of obviousness since all of the claimed limitations are not taught or suggested by the applied prior art references. Appellants contend (Brief, page 6) that, unlike Goossen in which no air space is formed in the fabrication process, claim 1 requires the natural formation of an air space between the connection bumps and the passivation layer. In a related argument (id., at 6-7), Appellants assert that, unlike the present invention, Goossen requires squeezing and heating steps to cure the underfill material.

After careful review of the applied prior art references in light of the arguments of record, however, we are in general agreement with the Examiner's position as stated in the Answer. Our interpretation of the disclosure of Goossen coincides with that of the Examiner, i.e., an air gap is clearly illustrated between the solder bump 61 and the passivation layer 46 in Goossen's Figure 4. Further, as pointed out by the Examiner (Answer, page 8), Appellants' arguments with regard to the

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squeezing and heating operations during the underfill process are not commensurate with the scope of claim 1 since any such squeezing and heating underfill curing steps are not precluded by the language of the claim.

Further, we find to be unpersuasive Appellants' argument (Brief, page 7) which attacks the Examiner's establishment of proper motivation for the proposed combination of references. We find no convincing arguments from Appellants that would convince us of any error in the Examiner's proposed combination of Goossen and Harper. In our view, as also asserted by the Examiner (Answer, pages 8 and 9), Goossen's suggestion of application of the described underfill process to multiple IC packages and Harper's teaching of complete wafer coverage of solder bumps before die cutting would suggest to the skilled artisan the obviousness of applying an underfill process such as disclosed by Goossen to a plurality of dies before the die-cutting process.

For the above reasons, since it is our opinion that the Examiner's prima facie case of obviousness has not been overcome by any convincing arguments from Appellants, the Examiner's 35 U.S.C. § 103(a) rejection of representative independent claim 1, as well as claims 2, 3, 5-7, and 14 which fall with claim 1, is sustained.

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Turning to a consideration of the Examiner's 35 U.S.C. § 103(a) rejection of independent claim 8 (the representative claim for Appellants' suggested grouping including claims 8-11 and 15)<sup>3</sup>, we also sustain the obviousness rejection of claim 8, and claims 9-11 and 15 which fall with claim 8. Appellants' arguments with respect to representative claim 8 focus (Brief, page 11) on the alleged lack of a teaching in either Goossen or Harper of a second layer of solder bumps. A review of the language of claim 8 reveals, however, that only first and second bumps are required, not solder bumps. As pointed out by the Examiner (Answer, page 7) Harper discloses (Figure 13) a connection bump with multiple metal layers having an illustrated polished face between the first and second layers.

Turning to a consideration of separately argued dependent claims 4 and 12, and their dependent claims 5 and 13, we note that while we found Appellants' arguments to be unpersuasive with respect to the Examiner's obviousness rejection of claims 1-3, 6-11, 14, and 15 discussed supra, we reach the opposite conclusion with respect to the obviousness rejection of claims 4, 5, 12, and 13. As indicated by Appellants (Brief, page 12),

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<sup>3</sup> Dependent claim 13, because of its dependency on claim 12, should properly be included in Appellants' suggested grouping with claim 12.

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claims 4, 5, 12, and 13 are directed to the embodiment in which a second underfilling process is performed after a flip-chip step which in turn is performed after a first underfilling process. While we agree with the Examiner that Goossen discloses the conventionality of performing underfilling after a flip-chip operation, we find no basis for the conclusion that the skilled artisan would have been motivated and found it obvious to perform this after flip-chip underfilling process in combination with a underfilling step performed before the flip-chip operation as claimed. The Examiner must not only make requisite findings, based on the evidence of record, but must also explain the reasoning by which the findings are deemed to support the asserted conclusion. See In re Lee, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433-34 (Fed. Cir. 2002). Accordingly, since all of the claimed limitations are not taught or suggested by the applied prior art references, the Examiner's 35 U.S.C. § 103(a) rejection of claims 4, 5, 12, and 13 is not sustained.

In summary, with respect to the Examiner's 35 U.S.C. § 103(a) rejection of the appealed claims, we have sustained the rejection of claims 1-3, 6-11, 14, and 15 , but have not sustained the rejection of claims 4, 5, 12, and 13. Therefore,



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