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# Datasheet for the decision of 10 November 2011

**Case Number:** T 2021/07 - 3.4.03

**Application Number:** 00918292.4

**Publication Number:** 1171911

**IPC:** H01L 21/56, H01L 23/31

**Language of the proceedings:** EN

**Title of invention:**
Lead frame moisture barrier for molded plastic electronic packages

**Applicant:**
RJR Polymers, Inc.

**Opponent:**
-

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 56

**Keyword:**
"Inventive step (denied)"

**Decisions cited:**
-

**Catchword:**
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

**Case Number:** T 2021/07 - 3.4.03

# D E C I S I O N
**of the Technical Board of Appeal 3.4.03**
**of 10 November 2011**

**Appellant**: (Applicant)
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**Decision under appeal:** **Decision of the Examining Division of the European Patent Office posted 12 July 2007 refusing European patent application No. 00918292.4 pursuant to Article 97(1) EPC 1973.**

**Composition of the Board:**

**Chairman:** G. Eliasson
**Members:** V. L. P. Frank
T. Karamanli

## Summary of Facts and Submissions

I. This is an appeal from the refusal of application 00 918 292 for lack of inventive step (Article 56 EPC 1973).

II. With the letter dated 26 October 2011 the appellant applicant informed the "examining division" [sic] that he would not attend the oral proceedings appointed by the board for the 10 November 2011. As announced, the appellant was not represented at the oral proceedings before the board.

The appellant requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 4 as filed with letter dated 3 August 2006 and claims 5 to 8 filed on entry into the European phase.

III. The sole independent claim of this request reads:

"1. A method for forming a hollow molded plastics enclosure penetrated by electrically conductive metallic leads to access a die to be sealed in the enclosure by molding walls of the enclosure around the leads, the method comprising the steps of:
(a) selectively stamping or printing a heat-curable adhesive on areas on the surface of the leads that will contact said enclosure walls when molded,
(b) molding said enclosure walls around said leads with the heat-curable adhesive thereon, and
(c) curing said heat-curable adhesive either during or subsequent to molding said enclosure

walls, said heat-curable adhesive selected such that, when cured, it will seal said enclosure walls around said leads in a manner substantially impermeable to gases."

IV. The following prior art documents are cited in this decision:

D1: JP 63 184 357 A and the English translation submitted by the applicant.

D2: US 5 816 158 A

V. The examining division argued essentially as follows:

The method of claim 1 differed from the method disclosed in document D1 in that the sealing adhesive was applied by stamping or printing. The problem addressed by the present invention could thus be considered as how to enhance the speed at which the sealing adhesive could be applied on the leads. The distinguishing feature was however described in document D2 as providing the advantage of enhancing the application speed of the adhesive. The skilled person would therefore have regarded it as a normal design option to include this feature in the method described in document Dl in order to solve the problem posed.

VI. The appellant applicant argued in writing essentially as follows:

– The applicant agreed with the examining division that the distinguishing feature with respect of D1 was to stamp or print the adhesive selectively on

areas on the surface of the leads that will contact the enclosure walls when moulded. In contrast, D1 disclosed a method in which an adhesive material was wound around the circumference of the terminals.

– As a first argumentation line, the applicant submitted that to reduce the distinction between D1 and the invention as claimed to one of speed of application of the adhesive was an oversimplification. The advantages arising from the present invention were:

(i) the creation of a gas-impermeable seal at the interface between the leads and the package body, while preserving the ability to form strong electrical contacts between the leads and the die circuitry,

(ii) the gas-impermeable seal was formed at a scale that was appropriate for the small scales used in electronics,

(iii) the gas-impermeable seal could consist of substances with different thermal contraction/expansion coefficients.

In D1 the adhesive was applied by winding an adhesive material around the circumference of the terminals. This resulted in a localized placement of the adhesive but was a cumbersome method and something that could not be done on a very small scale such as that typically encountered in an electronic package. The winding method also formed a rather thick layer and, according to the figures,

required a groove or depression in the wall. Furthermore, Dl clearly taught a method of selectively applying adhesive that required a circumferential application and that therefore the skilled person would discount any "two dimensional" methods such as stamping or printing as being ineffective or at least more difficult to perform. Contrary to this, the invention allowed a much wider variety of adhesive compositions to be used (not limited by the fact they had to be "windable") which allowed the adhesive to be tailored to the coefficients of thermal expansion (CTE) of lead frame material and package body.

Document D2 did not disclose or suggest a method of selectively stamping or printing an adhesive onto the surfaces of the leads with subsequent curing in order to create a gas-impermeable moisture barrier for molded plastic packages. D2 led away from the invention as claimed because in Example 1 the use of this technique to coat each and every lead within a package was disclosed, which was in contrast to the invention which suggested selective application of the adhesive.

– As a second argumentation line, the applicant accepted the objective technical problem identified by the examining division (ie to enhance the speed at which the sealing adhesive could be applied on the leads), but argued that the skilled person would not have combined the teaching of Dl with that of D2 for the following reasons:

In the claimed method, the adhesive was applied by a stamping and printing process whereby the adhesive was in liquid form. The liquid adhesive was stamped or printed on areas on the surface of the leads. The enclosure walls were subsequently molded around the leads using a resin in a molten state. Thus, the present application involved the application of a molten (liquid) resin over an uncured (liquid) adhesive, and despite the fact that the two were liquids and presumably could run into each other, either before or as they were being exposed to heat, they still surprisingly managed to form a leak-tight seal around the leads.

While the claimed method involved selectively stamping or printing a heat-curable adhesive on areas on the surface of the leads that would contact the enclosure walls when molded, the thermal adhesive in Dl was "wound" around the terminal. This implied that the adhesive of Dl was in a "windable" form, for example a solid thread, cord or tape. D2 disclosed a process for applying materials to a substrate, and listed adhesives as an example of such a material and electrical leads as examples of the substrate. D2 did not however disclose the subsequent step of molding around the leads that had the adhesives on them. The only disclosure in D2 of attaching something after the printed adhesive had been applied was the attaching of memory chips. Memory chips were fully formed, solid components. No molding and curing of a resin other than the adhesive itself was disclosed in D2.

A skilled person starting from the method of Dl would not have replaced the step of winding a solid adhesive with the step of stamping or printing a liquid adhesive as described in D2, because he would have assumed that the printed liquid adhesive of D2 would run into the molten resin of Dl and that the seal would therefore be inefficient. Neither Dl nor D2 disclosed curing a liquid adhesive by contacting it with a liquid resin during a molding process of the resin around the adhesive. In both Dl and D2, the bonds were formed by contacting a solid component (the winding thread in Dl and the memory chip in D2) with a liquid component (the resin in Dl and the adhesive on D2). It was therefore submitted that the subject-matter of claim 1 was inventive over the disclosure of Dl and D2.

Furthermore, according to Dl there was no danger of pinholes developing during the molding process, but the fact that Dl used a winding thread necessarily meant that there were gaps between the adjacent layers of thread in the winding. Thus, the gaps were present from the winding process, as opposed to being developed during curing (which occurred during the molding process). By contrast, the present method involved the homogeneous application of a liquid resin onto a liquid adhesive, and "pinholes" were not observed. The process described in Dl also included a preliminary heating step applied to the adhesive thread on the terminals after the thread was applied but before the molding step. The purpose of this preliminary step was to effect a

"provisional bonding" of the adhesive thread to the leads. This step seemed necessary when the adhesive was, as in Dl, applied as a thread rather than a liquid in the presently claimed method. If the adhesive was a resin or liquid, then the liquid’s surface tension would hold it in place. Only after the thread had been provisionally bonded to the terminals in this manner was the molding performed around the winding and the terminals, which heated the adhesive thread to a higher temperature and a longer period of time to provide "permanent" bonding. The claimed method did not require such a preliminary or provisional step.

## Reasons for the Decision

1. The appeal is admissible.

2. *Claim 1 – Inventive step (Article 56 EPC 1973)*

2.1 Document D1 discloses a method for forming a hollow moulded plastic enclosure penetrated by electrically conductive metallic leads, as usually used for packaging microelectronic semiconductor devices. To improve the sealing between the metallic leads 3 and the case 2 a thermal adhesive layer 6 is attached to the circumferential surface of the leads at the portion contacted by the case (cf the English translation of D1, page 1, "Prior Art", 1st paragraph; page 5, lines 1 to 5; Figure 2).

2.2 It is common ground that document D1 represents the closest state of the art and that the method of claim 1 differs from the method disclosed in D1 by step (a), namely that the heat-curable adhesive is selectively stamped or printed on areas on the surface of the leads that will contact the enclosure walls when moulded instead of being wound on them as done in D1.

2.3 The appellant applicant argued that the objective technical problem identified by the examining division based on this difference, namely to enhance the speed at which the sealing adhesive could be applied on the leads, was an oversimplification, since further advantages were attained by the method as claimed (see point VI, (i) to (iii)).

2.4 The board, however, is not persuaded that the advantages alleged in points (i) and (ii) arise from the way the adhesive is applied on the leads, since:

(i) the method of D1 already achieves a gas impermeable seal. This is a result, according to D1, from the use of an adhesive at the interface between the walls and the leads (page 4, last paragraph);

(ii) the method of D1 is explicitly intended for being employed at the small scales used in electronic semiconductor devices (page 5, lines 1 to 5).

2.5 Document D1 further discloses that a thermal adhesive based essentially on nitrile rubber or nitrile phenol is ideal for carrying out the method (page 4,

"Embodiments", last paragraph). The present application discloses instead the use of a larger variety of adhesives allowing to match the coefficients of thermal expansion (CTE) of the leads and the walls. This improves the reliability of the seal (page 1, line 27 to page 2, line 8; page 3, 3rd paragraph; page 4, line 26 to page 5, line 6; pages 7 and 8).

2.6 The board therefore considers that the possibility of using different adhesives should be taken into account when stating the problem addressed by the present invention.

The objective technical problem addressed by the invention can, having regard to document D1 as closest state of the art, be formulated therefore as follows: to enhance the speed at which the sealing adhesive can be applied on the leads and to improve the seal's reliability.

2.7 Document D2, however, discloses a method for transferring dots, lines or geometric designs of liquid print material form a bath to a flat or curved surface. To this effect a die containing a raised negative of the design to be printed is immersed in a bath of the liquid print material, the wet die is then exposed and contacted with the surface to be printed to transfer the print material from the die to the surface. According to D2, a multitude of liquid print materials can be printed in this way (eg solutions, suspensions, emulsions or fully concentrated materials such as uncured polymers). In a particular example, dots of a thermoplastic adhesive are deposited on specific spots of each and every lead of a leadframe. In a second

example a mineral-filled epoxy system was applied in the same way (column 1, lines 13 to 15 and 40 to 60; column 2, lines 54 to 64; column 4, line 41 to column 5, line 53; column 5, line 57 to column 6, line 23; Figure 2).

2.8 The board considers that the skilled person would recognize that the method of D2 allows a faster application of the adhesive on the leads of a leadframe than the winding method disclosed in D1. The method of D2 also allows a wider selection of adhesives making a better match between the different CTEs of walls and leads possible. The skilled person would thus recognize that the method of D2 provides a solution to the technical problem posed above.

2.9 The appellant applicant argued that D2 led away from the present invention, since it disclosed applying the adhesive on each and every lead of a leadframe whereas the method of claim 1 specified a "selective" application of the adhesive.

2.10 The board is not persuaded by this argument, since the "selective" application of the adhesive is contrasted in the present invention to the coating of the whole lead with adhesive, with the subsequent cleaning of the leads after the moulding operation (page 2, lines 25 to 33). The "selective" application of adhesive means therefore under the present circumstances that the adhesive is only applied at the locations where the moulded walls will contact the leads. This however is also how the print material is applied according to document D2, namely at the sites where the leads contact the memory chip.

2.11 The appellant applicant also argued that the skilled person would not have combined documents D1 and D2, since D2 disclosed that the printed adhesive was used for fixing a memory chip onto the leads of the leadframe, ie for joining two solid objects. There was no disclosure in D2 that the method could be used for joining something other than two solid objects. In contrast, according to the present invention, the uncured adhesive was contacted by the molten resin of the enclosure walls and the adhesive was cured either during or subsequent to moulding the enclosure walls. The skilled person would have assumed that the liquid adhesive of D2 would run into the molten resin of D1 and that the seal would therefore be inefficient.

2.12 The board is also not persuaded by this argument. The notional skilled person has been defined as knowing the whole state of the art, but being unable to recognize any unobvious combination for lack of imagination. This lack of imagination however also renders him unable to foresee problems that are not explicitly stated in the prior art or are not immediately apparent to a technically skilled person.

2.13 Document D1 discloses that the presence of an adhesive on the leads of a leadframe improves the seal with the moulded walls of the enclosure. D2 on the other hand discloses a faster and simpler method for applying an adhesive on a surface, eg on the leads of a leadframe. There is no explicit warning in D2 to use the method for joining only two solid objects. In fact the question of which objects can be joined is not addressed in this document. There is also no

immediately recognizable technical reason for not using the adhesive's application method of D2 in the moulding of the enclosure according to D1.

2.14 The appellant applicant also argued that the claimed method rendered the preliminary heating step disclosed in D1 unnecessary. This step was necessary to provisionally bond the wound adhesive onto the leads, as otherwise the solid adhesive thread could fall of from the leads. In the present invention such a provisional heating step was not required, since the liquid adhesive remained in place due to its surface tension.

2.15 The board however considers that by replacing the way of applying the adhesive in D1 by the one disclosed in D2, ie printing a liquid adhesive instead of winding a solid or semisolid thread, the preliminary heating step is automatically rendered unnecessary, since no such step is disclosed in D2. This is not a further bonus of the invention, but a direct replacement of one way of applying the adhesive by another.

2.16 The board judges for the above reasons that the skilled person would have replaced the method of applying the adhesive of document D1 by the one disclosed in document D2, as this improves the adhesive's application speed and the reliability of the seal. The method of claim 1 therefore does not involve an inventive step in the sense of Article 56 EPC 1973.

## Order

## For these reasons it is decided that:

The appeal is dismissed.

Registrar | Chair

S. Sánchez Chiquero | G. Eliasson