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Datasheet for the decision of 23 May 2007

Case Number: T 1911/06 - 3.2.06

Application Number: 01113598.5

Publication Number: 1166938

IPC: B23K 1/19

Language of the proceedings: EN

Title of invention:
PB-free soldering alloy

Patentee:
Nihon Almit Co., Ltd.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1911/06 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 23 May 2007

Appellant: Nihon Almit Co., Ltd.
Almit Bldg.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 1 August 2006 refusing European application No. 01113598.5 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. Alting Van Geusau
Members: G. de Crignis
R. Menapace

Summary of Facts and Submissions

I. European patent application No. 01113598.5 published as EP-A-1 166 938 was refused by decision of the Examining Division dated 1 August 2006.

The independent claims of the applicant's main and auxiliary requests on which the decision of the Examining Division is based read as follows:

Main Request:
"1. Pb-free soldering alloy for soldering Cu comprised in a printed-circuit board, characterized in that it comprises:
Ag of 3.5 to 6.0 wt.%,
Ni of 0.001 to 1.0 wt.%,
P of 0.001 to 1 wt.%,
Ga of 0.001 to 1 wt.%,
Sn of the balance."
"2. Pb-free soldering alloy for soldering Cu comprised in a printed-circuit board, characterized in that it comprises:
Ag of 3.5 to 6.0 wt. %,
Ni of 0.001 to 1.0 wt.%,
Ge of 0.001 to 1 wt.%,
Ga of 0.001 to 1 wt.%, and
Sn of the balance."

Auxiliary request:
"1. Pb-free soldering alloy for soldering Cu comprised in a printed-circuit board, characterized in that it comprises:
Ag of 3.5 to 6.0 wt.%,
Ni of 0.001 to 1.0 wt.%,

P or Ge of 0.001 to 1 wt.%,
Ga of 0.001 to 1 wt.%, and
Sn of the balance."

II. In the course of the examination proceedings, the Examining Division issued a first communication dated 4 October 2004 in which it informed the applicant that the subject-matter of originally filed claim 1 was neither new with regard to Article 54(3) EPC over the disclosure of

D1 EP-A-1 088 615

nor new with regard to Article 54(1) and (2) EPC over the disclosure of each of the documents

D2 DE-A-19816 671
D3 EP-A-0 847 829
D4 DE-A-38 30 694.

It then issued a second communication dated 11 May 2005 in which it set out that the subject-matter of an amended claim did not meet the requirements of Article 123(2) EPC and furthermore was not considered to involve an inventive step when starting from the sixth example of Table 3 in D2 and when taking into account the disclosure of

D7 Patent Abstracts of Japan Vol. 004, No 117 (E-022) 20 August 1980, JP 55 072048, 30 May 1980.

The Examining Division issued a summons to oral proceedings with letter of 13 February 2006 in which it maintained its view with regard to lack of inventive

step. With letter dated 19 May 2006, the applicant filed a main and an auxiliary request comprising the claims set out above.

After having held the oral proceedings on 27 June 2006 in the absence of the applicant which had announced before its probable non-attendance with letter dated 20 June 2006, the Examining Division issued the decision to refuse the application on 1 August 2006.

III. The appellant filed an appeal against this decision, received at the EPO on 27 September 2006, and simultaneously paid the appeal fee. With the statement setting out the grounds of appeal, received at the EPO on 23 November 2006, the appellant requested that the decision of the Examining Division be set aside and the case be remitted for further examination on the basis of the claims on which the decision of the Examining Division was based.

IV. With letter of 23 February 2007 the Board summoned the appellant to oral proceedings pursuant to Rule 71(1) EPC. In the annex to the summons, the Board indicated that it shared the view of the Examining Division that the soldering alloy disclosed in the sixth example of Table 3 of D2 represented the closest prior art. Furthermore, it pointed out that the only distinguishing feature was the addition of Ga in the range of 0.001 to 1 wt % to the solder alloy and that the examples in the application in suit did not provide any support for relating this addition to the alleged effect over the whole range claimed.

V. During oral proceedings held on 23 May 2007, at the end of which the decision of the Board was announced, the appellant maintained the requests made in the written proceedings to set aside the decision under appeal and to grant the patent on the basis of either claims 1 and 2 of the main request or on the basis of claim 1 of the auxiliary request, both requests having been filed with letter of 19 May 2006.

VI. The appellant's submissions in support of its requests were essentially the following:

D2 represented the most relevant state of the art. It disclosed in a general manner Sn/Ag alloys and referred to the problem of the provision of Pb-free soldering alloys improving the reliability of the soldering (good strength, thermal stability, minor surface oxidation). Example 6 in Table 3 disclosed an alloy with a content of 3.5 wt% Ag, 0.2 % Ni, 0.05 wt% Ge, with Sn as the balance.

D7 disclosed a semiconductor element comprising a semiconductor chip and a metal plate which was connected with the semiconductor chip by a preformed solder. The disclosed solder and solder alloys concerned only Sn-Ga alloys in the sense that only these metals were present. No alloys having other metals incorporated were shown in the sole table. In particular, no Sn/Ag alloy was mentioned at all.

When starting from example 6 of Table 3 of D2, the skilled person would not rely on the teaching of D7 because D7 disclosed nothing else than adding Ga to Sn in order to form a soldering alloy of the type Sn-Ga

for improving anti-oxidizability and mechanical strength of the soldered part in relation to the bonding between a semiconductor and a metal plate. Thus there was no teaching in D2 or D7 which would have prompted the skilled person to modify or adapt the soldering alloys of D2. Hence, it was not obvious to add Ga to a solder alloy of the type Sn/Ag so that the subject-matter claimed involved an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Novelty*

Novelty of the claims has not been disputed. None of the cited documents discloses a Pb-free soldering alloy in the claimed composition. Hence, claims 1 and 2 of the main request and claim 1 of the auxiliary request meet the requirements of Article 54(1) EPC.

3. *Inventive step*

The closest prior art in relation to the soldering alloy according to all the claims is represented by D2. This document discloses Sn/Ag soldering alloys which additionally contain either Cu and/or Ni in order to improve the thermal stability (claim 4, page 10, l. 31/32). It further discloses adding at least one additive selected from a group consisting of P and Ge in an amount of up to 1 wt% (claim 5, page 10, l. 35/36). In the sixth example in Table 3 of D2 a soldering alloy is disclosed with an amount of Sn, Ag,

Ni and Ge within the range claimed in the application in suit for the composition of the alloy.

With respect to the subject-matter claimed in all independent claims of the application in suit, D2 does not disclose a soldering alloy "comprising Ga of 0.001 to 1 wt.%". It has to be established which technical result or effect is achieved by the claimed soldering alloy comprising Ga when compared with the soldering alloy disclosed in D2 and which technical problem is solved.

3.1 Examples 1 to 6 of the application in suit (Table 2) do not indicate whether the addition of Ga in an amount different from 0.03 wt% or 0.05 wt% influences the test result in the desired way nor whether Ga influences the test result at all because none of the examples is unvaried in all other components. In particular, they do not provide any evidence that an effect different from, or additional to, the effect of P or Ge is obtained by the addition of Ga. They do show however that the addition of P and Ge with respect to dross generation is advantageous over the addition of Ga. In none of the examples can any special advantage of Ga be recognized, in particular considering the broad range claimed.

3.2 The examining division considered the underlying technical problem to be solved by the claimed alloy to be the provision of Pb-free soldering alloys with improved reliability of the soldering between Cu-comprising printed circuit boards and other electronic parts. However, this problem is already solved by the soldering alloy of example 6 in Table 3 of D2.

Therefore, and in the absence of any improvement (see point 3.2 above), the problem to be solved can only be finding an alternative to the addition of P and/or Ge to the soldering alloy.

3.3 D2 explains the reasons and advantages of the addition of P and Ge to the soldering alloy. One such advantage is the suppression of the oxidation of Sn which results in less surface oxidation during soldering (less dross) but also in more stability of produced solders. Another advantage concerns improvements in tensile strength and fracture elongation of the solder alloy as well as improvements in thermal stability and wettability (page 12, l. 18 - 21). D2 refers to the elements P and Ge with the same emphasis. According to the description (page 10, l. 35/36, page 10, l. 63 - 67, page 11, l. 7/8, page 12, l. 7 - 17) they can be used as alternatives or in combination.

3.4 The skilled person looking for an alternative to P and/or Ge and studying D7 recognizes that it discloses a solder in the form of a Sn or Sn-based alloy for connecting a semiconductor element and a metal plate. The disclosed solder and solder alloys concern Sn-Ga alloys in that the sole table in D7 shows exemplarily the effect of Ga on Sn. No alloys having other metals incorporated are shown in this table. However, Sn-based alloys are mentioned repeatedly and consistently, together with the pure Sn-alloy in the description (see English translation of D7 on page 2, last line, on page 4, line 22 and on page 5, line 13).

3.5 The appellant's argument that D7 does not directly disclose an example of the addition of Ga to a Sn/Ag

alloy is correct. However, D7 points to similar advantages and reasons for the addition of Ga as given in D2 for the addition of P and Ge. These advantages are specified in D7 to the effect that an amount of Ga in the preformed solder is used in order to enhance the mechanical strength and to improve the oxidation resisting properties of the Sn solder or Sn-based solder alloy. Therefore, the skilled person would immediately infer, that Ga can be used as an alternative element to P and/or Ge in any Sn-based solder alloy.

3.6 The Examining Division had already considered the introduction of Ga as a straightforward alternative and had argued that the introduction of Ga in the claimed amount in a Pb-free soldering alloy would provide the same technical effect as Ge or P. No arguments or evidence to the contrary have been put forward.

3.7 Hence, at the priority date of the application in question the addition of Ga as an alternative to the addition of P or/and Ge in Sn-alloys or Sn-based solder alloys would have been having been considered obvious by persons skilled in the art.

3.8 Concerning the range defined in the claim, D7 emphasizes that Ga improves the anti-oxidizability of a Sn-based soldering alloy only when added in an amount of between 0.01 wt % and 0.5 wt % (page 5, lines 1 to 8). The range claimed in the application under consideration (0.001 to 1 wt %) extends beyond this range, whereas the examples only provide support for an addition of either 0.03 or 0.05 wt% of Ga. No data is available which supports any specific effect outside of

the examples taken only at two specific points. Hence, even the parts of the range which extend outside the range specified in D7 cannot give support to any inventive concept.

3.9 In conclusion, the subject-matter of claims 1 and 2 of the main request and of claim 1 of the auxiliary request does not involve an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Patin P. Alting van Geusau