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Datasheet for the decision of 17 September 2013

Case Number: T 0114/12 - 3.2.06

Application Number: 02291590.4

Publication Number: 1273384

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Language of the proceedings: EN

Title of invention:
Lead-free solder alloy

Applicant:
SENJU METAL INDUSTRY CO., LTD.

Headword:
-

Relevant legal provisions:
RPBA Art. 13(1)
EPC Art. 56, 123(2)

Keyword:
"Auxiliary requests filed after arrangement of oral proceedings - not *prima facie* allowable - admitted (no)"
"Inventive step - main request (no)"

Decisions cited:
G 0002/88, T 0201/83

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0114/12 - 3.2.06

D E C I S I O N
of the Technical Board of Appeal 3.2.06
of 17 September 2013

Appellant: (Applicant)
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Decision under appeal:
Decision of the Examining Division of the European Patent Office posted 19 July 2011 refusing European patent application No. 02291590.4 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: M. Harrison
Members: G. de Crignis
W. Sekretaruk

Summary of Facts and Submissions

I. The Examining Division refused European patent application No. 02 291 590.4 holding that the subject-matter of claim 1 of the main request was not novel (Article 54 EPC) over

D1 US-A-5 980 822

D2 WO-A-01/03878

D3 EP-A-0 336 575

D4 patent abstract of JP 10 034376 & JP 10 034376

D5 patent abstract of JP 2000 015476 & JP 2000 015476

D6 patent abstract of JP 2001 071173 & JP 2001 071173,

that the subject-matter of claim 1 of auxiliary request 1 was not novel over D2, and that the subject-matter of claim 1 of auxiliary request 2 did not meet the requirement of Article 56 EPC when starting the assessment of inventive step from D2 and combining it with D6.

II. The appellant (applicant) filed an appeal against this decision and paid the appeal fee. In its statement setting out the grounds of appeal the appellant filed a main request and seven auxiliary requests.

III. In a communication sent as an annex to a summons to oral proceedings, the Board maintained the novelty objection with regard to the main request and raised further objections concerning Article 123(2) EPC and Article 84 EPC (clarity) with regard to the auxiliary requests.

IV. With letter of 16 August 2013, the appellant filed a new main request and first to eighth auxiliary requests, replacing all previous requests.

V. Oral proceedings were held on 17 September 2012. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the main request or one of the auxiliary requests 1 to 3, all dated 16 August 2013, or one of the auxiliary requests 4 or 5, dated 17 September 2013.

During the oral proceedings, the appellant also submitted:
D4a machine translation of D4 into English
D5a machine translation of D5 into English.

The appellant also referred *inter alia* to
D6a machine translation of D6
E1 table 2 of JIS Z 3282, 2006
E2 Figure 1 showing zero-cross time of Sn0.7Cu and Sn0.7Cu0.1Ni alloys
E3 JIS Z 3198-4; 2003
E4 JIS Z 3198-3; 2003
E10 translation of rejection of D6
E11 Figures 1 to 4 and Tables 1 to 3, concerning tensile and pull strength test results and also wetting test data.

VI. Claim 1 of the main request has the following text:
"A lead-free solder alloy consisting of
0.1 - 3 wt% of Cu,
0.001 - 0.1 wt% of P,
one or more strength-improving elements selected from the group consisting of Ni, Co, Fe, Mn, Cr, and Mo in a total amount of at most 0.5 wt%,
optionally 0.001 - 0.1 wt% of Ge, and
a balance of Sn."

Claim 1 of auxiliary request I differs from claim 1 of the main request in that the feature
"one or more strength-improving elements selected from the group consisting of Ni, Co, Fe, Mn, Cr, and Mo in a total amount of at most 0.5 wt%" is replaced by
"at most 0.5 wt% of Ni as strength improving element".

Claim 1 of auxiliary request II differs from claim 1 of the main request in that the feature
"one or more strength-improving elements selected from the group consisting of Ni, Co, Fe, Mn, Cr, and Mo in a total amount of at most 0.5 wt%" is replaced by
"0.05 - 0.5 wt% of Ni".

Claim 1 of auxiliary request III differs from claim 1 of the auxiliary request II in that the feature
"0.001 - 0.1 wt% of P" is replaced by
"0.003 - 0.1 wt% of P".

Claim 1 of auxiliary request IV differs from claim 1 of auxiliary request I in that the feature
"at most 0.5 wt% of Ni as strength improving element" is replaced by
"at most 0.5 wt% of Ni"; and in that the word "optionally" is deleted in the feature "optionally 0.001 - 0.1 wt% of Ge".

Claim 1 of auxiliary request V reads:
"Use of 0.001 - 0.1 wt% of P and of 0.001 - 0.1 wt% of Ge for improving wettability in terms of zero-cross time, measured by a wetting balance test, of a lead-free solder alloy, wherein the lead-free solder alloy consists of, after addition of P and Ge:

0.1 - 3 wt% of Cu,
0.001 - 0.1 wt% of P,
at most 0.5 wt% of Ni,
0.001 - 0.1 wt% of Ge, and
a balance of Sn."

VII. The arguments of the appellant may be summarised as follows:

Claim 1 according to the main request should be admitted. It was amended to identify the strength-improving elements as being mandatory. D2 represented the closest prior art. It disclosed a lead-free solder alloy which did not include any of the claimed strength-improving elements. Therefore, the subject-matter of claim 1 was novel over D2. D2 further had the object of avoiding dross formation which taught away from using Ni, and did not mention the relevance of strength or wetting behaviour of the alloy. Hence, the skilled person would not consider the combination of D2 with any of the cited documents disclosing the use of Ni.

When considering D2 in combination with D5 and the objective problem of improving the strength of the alloy, D5 disclosed that Ni and P were strength-improving elements to reinforce the solder alloy which included Ag, Cu, Bi and Sn, since that alloy was described to be hard and brittle but weak in mechanical strength. Hence a person skilled in the art was motivated to add Ni (and P) only in the case when this particular combination of elements was used. It should also be taken into account that the term "strength-improving elements" such as used in the application in

suit indicated that at least one of these elements had to be added intentionally with an aim to improve strength, which signified that at least one of these elements had to be present in an effective amount. Entirely ineffective amounts (impurities) would not qualify as such. The skilled person knew that any amount below 0.01% of Ni represented merely an impurity level. Such considerations also applied to the other elements. Evidence for such consideration was presented by E1. Therefore, the amounts of Ni applied in D5 (according to D5a) were not sufficient for providing any effect, and Bi was the main contributor to mechanical strength as was clear from Tables 7 and 8; Ni was not used to increase strength.

Concerning claim 1 of auxiliary request I, the same arguments applied as for the main request.

With respect to auxiliary requests II and III, decision T0201/83 confirmed that (upper or) lower boundary/ies could be chosen for a claimed range irrespective of whether there specific examples were disclosed for such a range. In particular, merely because there is some relationship between features does not mean that the features of an embodiment cannot be used in a claim, separately to other features in the embodiment, if the features included in the claim are not so closely associated with other features of the embodiment that their effect can be determined. In the present case, the effects of P and Ni and the associated content of each can be understood separately. Additionally, E11 provided, in its Figure 1 and Table 1 evidence for the improvement of tensile strength by the addition of Ni to SnCuGeP-alloys. Figure 2 showed an improvement in

pull strength at room temperature and at 125°C when comparing Sn0.7Cu0.003P with Sn0.7Cu0.003P0.05Ni. Additionally, Figure 4 of E11 demonstrated that P and Ni in an alloy had a pronounced strength-improving effect.

With respect to auxiliary request IV, claim 1 was amended to specify an alloy including Ge as a component. The addition of Ge contributed to improved wettability of the alloy, in particular in combination with P. Although D6 disclosed a solder which consisted of Sn, Cu, Ag, Ga, P and Ni and referred to Ge as improving solderability, D6 referred to solderability in terms of wettability in a static manner according to a slow-working spread test. Hence, D6 did not suggest to use Ge in order to improve dynamic wettability such as disclosed in the application in suit. Additionally, the data disclosed in the Tables in D6 evidenced that there was no significant improvement in static wettability when adding Ge to the alloy. Therefore, no hint to apply Ge for improving wettability in any respect could be derived from D6. The lack of convincing improvement of wettability was also evident from D6 which was rejected by the Japanese patent office (see E10).

Auxiliary request V should be admitted into the proceedings. Claim 1 of this request included the further feature specifically addressing the test method for dynamic wettability and thus overcame the previously raised objections. Wettability evaluated in terms of spreading was functionally different to wettability evaluated in terms of zero-cross time. Although the skilled person knew both kinds of wettability and the corresponding JIS methods, no

suggestion was present in any of the cited prior art documents to apply a test for dynamic wettability in order to arrive at meaningful test results.

G 2/88 already ruled that a claim relating to a new use of a known compound reflecting a distinct technical effect could be allowable. Evidence of the technical effect was provided by the test data submitted *inter alia* in E11, and the relevance of such test method was disclosed in the application in suit.

Reasons for the Decision

1. *Procedural considerations for admittance of requests*

The main request and auxiliary requests 1 to 3 were filed in reply to the communication of the Board, and auxiliary requests 4 and 5 were filed during the oral proceedings in reaction to the discussions therein. According to Article 13(1) of the Rules of Procedure of the Boards of Appeal (RPBA), it lies within the discretion of the Board to allow an appellant to amend its case after filing the grounds of appeal and thus to admit such requests into proceedings. This discretion is to be exercised in view of *inter alia* the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy.

2. *Main Request - admittance*

2.1 Compared to the previous main request, the subject-matter of claim 1 of the main request was amended by deleting the terminology "having improved wettability"

and by rendering mandatory the feature of the strength-improving elements being selected from the group consisting of Ni, Co, Fe, Mn, Cr and Mo in a total amount of at least 0.5 wt% (as a result of removing the word "optionally").

2.2 Since these amendments overcome the corresponding objections set out in the communication of the Board, the Board exercised its discretion and admitted this request into the proceedings.

3. *Prior art - D2*

D2 discloses a lead-free solder alloy which consists of Sn to which is/are added one or more of Ag (up to 10%), Cu (up to 5%), Sb (up to 10%) and Bi (up to 10%) and which contains P in an amount of up to 0.01% (all percentages being on a weight basis related to the amount of tin) (claim 1 of D2).

During the oral proceedings the appellant did not reiterate its allegation made in writing concerning D2 constituting a non-enabling disclosure that the range for P disclosed in D2 would be an error, in that commonly higher P contents were needed for reducing oxidation and in that no experimental confirmation of any effect on wettability was disclosed in D2. The Board thus maintained its view expressed already in its communication sent as an annex to summons that D2 states the advantageous effects of P concerning breaking up the dross and suppression of formation of an oxide layer. D2 is thus regarded as a relevant and enabling prior art document.

4. *Main request - claim 1 - novelty*

Claim 1 concerns a lead-free solder alloy mainly consisting of Sn and including Cu and P as also disclosed in D2. However, D2 does not refer to such an alloy containing either Ni, Co, Fe, Mn, Cr or Mo in a total amount of at most 0.5%. Thus, the subject-matter of claim 1 is novel over this prior art document.

Also, no other cited document discloses the claimed combination of components for a lead-free solder alloy. Thus the requirement of Article 54 (1) EPC is met.

5. *Main request - claim 1 - inventive step*

5.1 When starting the assessment of inventive step from the disclosure in D2, the problem to be solved has to be based on the distinguishing feature, which is the composition including at least one element of the group of strength-improving elements and its content in the alloy.

5.2 Hence, the objective technical problem to be solved starting from D2 is to improve the strength of the alloy. This object and its solution are disclosed in paragraphs [0024] and [0025] of the application in suit, whereby the solution is the inclusion into the alloy of at least one strength-improving element (which should be applied in a suitable/effective range).

5.3 D5 discloses a lead-free solder alloy based on Sn and refers in the abstract to the addition of Ni in an amount of 0.001 to 0.01 % to the alloy in order to have

the effect of improved mechanical strength. The description (see paragraph [0013] of D5a) states that the addition of Ni "makes a solder organization miniaturize more and a mechanical property is made to improve further ...".

5.4 Hence, the skilled person was taught by D5 that the mechanical strength of lead-free solders could be improved with regard to mechanical strength by the addition of Ni. No lower limit is claimed for the amount of Ni to be used; hence, the amounts disclosed in D5 fall within the claimed range. Thus, when starting from D2 and considering the problem to be solved, the skilled person is taught by D5 to add Ni in an amount falling within the claim, whereby no inventive step can be accorded to such feature within the subject-matter of claim 1 and the subject-matter of claim 1 therefore does not meet the requirement of Article 56 EPC.

5.5 The appellant argued that the small contents of Ni in the alloy of D5 would not be effective with regard to the improvement of mechanical strength. E1 was cited as demonstrating that amounts below 0.01% would correspond to non-effective amounts or to impurity amounts. However, E1 only specifies that the amount of Ni in the cited Sn99.3Cu0.7 alloy was not specified and that in the further Sn-Cu alloys, a content of 0.01% Ni was included. No statement concerning the effect of such content is present in E1.

5.6 The appellant further submitted during the oral proceedings a machine translation into English of the Japanese document D5 which was denoted D5a and

indicated that the Tables in this document would not support an effect of Ni with regard to mechanical strength. Therefore, the skilled person would doubt whether the effect which is reported in the description and in the abstract of D5 was actually obtainable by using Ni.

5.7 The Board cannot agree with this approach since the Tables in D5 fail to provide a comparison between alloys where only the amount of Ni is altered but which otherwise remain unaltered in their compositions. The examples 1-06 (Ni 0.001%) and 1-24 (Ni 0.01%) which were referred to by the appellant - are also altered in their composition with regard to Ag, Cu and P. Therefore, the influence of the amount of Ni upon mechanical strength cannot be determined. Moreover, Table 10 of D5a demonstrates that the tensile strength of the example 1-24 is - although only slightly - higher that the tensile strength of example 1-06 and hence, the general statement in the description is not contradicted.

5.8 Moreover, the appellant considered D2 as emphasizing the teaching of avoidance of the formation of dross and therefore as teaching away from the addition of Ni which would increase dross formation.

5.9 The Board is also of the view that dross formation is necessarily something generally to be considered in soldering. The references in D2 on page 1, line 17 and on page 2, lines 21/22 and on page 2, line 32 to page 3, line 4, take into account the effect of phosphorous in this respect. However, no indication is present which refers to avoiding Ni. Even accepting that the skilled

person was aware of a negative influence in this respect, dross formation always occurs and with regard to mechanical strength as well as other properties (wettability) a balance/trade-off has to be found. In such case in view of the problem of improving strength, the skilled person should choose carefully the amount of Ni within the claimed range such that the formation of dross remains acceptable.

5.10 Moreover, the appellant referred to D5 as addressing alloys including Ag and Bi - and thus having a different microstructure - which would lead the skilled person to adapt the alloy composition in this respect.

5.11 This argument is not convincing, since paragraph [0013] of D5 in particular emphasizes the improvement of the mechanical strength by the addition of Ni. The improvement of this mechanical property is disclosed as being effective even in a range of 0.004 to 0.006mass% of Ni. Hence, very small amounts of Ni appear to be sufficient. No need to add other elements is therefore present when only desiring to improve mechanical strength. Claim 1 does not define a lower limit for the addition of Ni and thus the range for Ni being effective in D5 is included in the claimed subject-matter. Thus, the conclusion can only remain that the subject-matter of claim 1 lacks an inventive step (Article 56 EPC).

6. *Auxiliary request I*

Claim 1 of auxiliary request I differs from claim 1 of the main request in that the feature

"one or more strength-improving elements selected from the group consisting of Ni, Co, Fe, Mn, Cr, and Mo in a total amount of at most 0.5 wt%" has been amended to read "at most 0.5 wt% of Ni as strength improving element".

This amendment is not suitable to change the finding on inventive step set out above because the amounts disclosed in D5 fall within this range. Therefore, such claim is *prima facie* not allowable and - since this request was filed after the communication of the Board and therefore represents a change to the appellant's case after filing its grounds of appeal - the Board exercised its discretion not to admit this request into the proceedings, in accordance with Article 13(1) RPBA.

7. *Auxiliary request II*

7.1 Claim 1 of auxiliary request II differs from claim 1 of the preceding requests in that the range claimed for Ni was amended to have a lower boundary of 0.05 wt%, to provide the range "0.05 - 0.5 wt% of Ni".

7.2 The disclosure in the application as filed nowhere refers to such a range. The value of 0.05 wt% of Ni is disclosed only once in the specification, namely in the Table related to Example 6, which exemplary alloy has a composition of Sn0.7Cu0.003P0.01Ge0.05Ni. Hence, there is only a disclosure concerning such a value of Ni in this particular alloy, but no general disclosure for this value constituting the lower boundary of a range concerning all compositions of the alloy which are possible within the various claimed ranges.

7.3 The appellant referred in particular to T 0201/83 and considered it relevant that this decision pertained also to an alloy although featuring the components Mg and Ca. The relationship of these components in the alloy claimed therein was considered as not being so close that it restricted these elements to the specific values given in the examples. The appellant argued that the same should also be applied in the present case.

7.4 However, contrary to the application underlying T 0201/83 which includes a Table demonstrating that corrosion resistance is very good when having Ca and Mg in the finally claimed combination of ranges contrary to other combinations of ranges, there is no such evidence concerning mechanical strength in the application in suit. No effect is shown for an alloy including Ni in the claimed range, concerning improvement of strength or any other characteristic. Example 6 of the application in suit represents the only alloy including Ni (in an amount of 0.05%) and for bulk strength a value of 33 MPa is indicated whereas for examples without Ni values up to 73 MPa are given. Additionally this example includes a specific content of P and Ge - whereas Ge is claimed only as being "optional". Hence, no effect concerning improvement of strength can be identified with regard to a content of Ni generally for the claimed alloy. Therefore, contrary to the application underlying T 0201/83, no link between the content of Ni and any desired properties can be established independently of other properties of the alloy.

7.5 The reference of the appellant to Figure 1 and Table 1 of E11 which disclose that tensile strength of a

particular SnCuGePNi alloy increases with increasing Ni content, relates specifically to alloys including Ge. In view of Ge being claimed as an optional component, no general information can be drawn from this Figure or Table. Also, the curves presented in Figure 4 of E11 do not provide data for an alloy including (Sn, Cu, P and) Ni but excluding Ge. Thus, no evidence for a lower limit for Ni in the claimed range is present via the information given in E11. The appellant's statement that Ge would be functionally independent on Ni has not been supported by any evidence and therefore cannot be considered proven; it is therefore not taken into account.

7.6 Thus, there is no disclosure for the range of 0.05 to 0.5 wt% Ni as defined in claim 1, whereby claim 1 contains subject-matter extending beyond the content of the application as originally filed contrary to Article 123(2) EPC. Consequently, the request is *prima facie* not allowable and - since this request was filed after the communication of the Board and is thus a change of the appellant's case - this request was not admitted into the proceedings by the Board when exercising its discretion according to Article 13(1) RPBA.

8. *Auxiliary request III*

Claim 1 of auxiliary request III differs from claim 1 of auxiliary request II in that the feature "0.001 - 0.1 wt% of P" has been amended to read "0.003 - 0.1 wt% of P".

This amendment does not overcome the Board's finding concerning the lack of disclosure (Article 123(2) EPC) of the lower limit claimed for Ni as set out above for auxiliary request II. Therefore, also this claim is *prima facie* not allowable and - since also this request was filed after the communication of the Board - and thus again represents a change of the appellant's case, the Board exercised its discretion not to admit this request into the proceedings in accordance with Article 13(1) RPBA.

9. *Auxiliary request IV*

9.1 Claim 1 differs from claim 1 of auxiliary requests II and III in that it has been amended to refer again only to an upper boundary for the content of Ni and so as to include the defined range of Ge mandatorily. Due to the latter amendment, the claimed subject-matter is further distinguished from the disclosure in D2.

9.2 The general object specified in the application as filed refers to the provision of good solder wettability (see paragraph [0013]). According to the description in paragraphs [0014] and [0019], this object is achieved by the addition of P to a Sn-Cu lead-free solder alloy and the effect can be further increased by the addition of P in combination with Ge (paragraphs [0019] - [0021] and [0023]). The data in the Table in paragraph [0031] confirms an improvement in wettability for compositions which include P and Ge (examples 3 and 6) in that they are rated "good" and "excellent" in wettability when compared to the basic Sn0.7Cu alloys (comparative examples 1 and 2) which are rated "poor" in wettability. However, there are also

data for alloys including only P but not including Ge (examples 1 and 2) and these exemplary alloys are already rated "excellent" in wettability and hence, no synergistic effect for P and Ge is disclosed. Thus, the argument of the appellant that it would be the combined action of P and Ge which contributed to the inventive concept is not consistent with the disclosed data and is thus not found convincing. The additional data submitted via Table 2 of E11 concerns the same examples as in the Table disclosed in paragraph [0031] of the application and it confirms the above results and conclusions.

9.3 Accordingly, when starting the assessment of inventive step from D2, and considering the features of claim 1 not disclosed therein, the objective technical problem to be solved is to further improve the wettability of an alloy which already includes P.

9.4 D6 (and its machine translation D6a) discloses a lead-free solder alloy. D6a, paragraph [0023], indicates that the addition of Ge to such an alloy composition is effective in improving solderability as well as mechanical properties, and that the content of Ge should be in the range of 0.001 mass% to 0.1 mass% in order to avoid a sharp increase in the melting temperature. Consistent therewith, paragraph [0054] of D6a indicates that via the addition of Ge, wettability and mechanical properties can be improved. Thus, no inventive step can be attributed to using such element in a lead-free alloy in the consistently claimed range for such purpose, contrary to Article 56 EPC.

9.5 The appellant objected that the term "solderability" used in D6a would be different to "wettability" and that a particular kind of wettability was to be understood according to the application in suit which referred to wettability in terms of reduced zero-cross time. Although it is true that D6a refers, with regard to the assessment of solderability/wettability, to data concerning spread ratio, claim 1 of the application in suit does not concern any particular wettability. Accordingly, the appellant's argument is not accepted.

9.6 Further, the appellant was of the view that a skilled person would not attribute any technical effect to the addition of Ge when considering the data in D6 since these data - according to the Tables disclosed in D6a concerning the change in spreading ratio (static wettability) - allegedly only show that the differences between the relevant alloys were insignificant.
Thus when comparing (in D6a) example 4 in Table 7 (Sn0.5Ag0.7Cu) having a spreading ratio of 75.8 (Table 8) with example 2-06 in Table 2 (Sn0.7Cu0.05Ga0.005P0.5Ag0.008Ni0.10Ge) having a spreading ratio of 76.0 (Table 10), no real increase in wettability would allegedly be observable even though the latter alloy included P and Ge. Therefore, the skilled person would allegedly not have concluded that there is an effect of Ge on wettability - even in the sense this term is used in D6a.

9.7 The Board is not convinced by this argument, since there are further components changed in these exemplary alloys which render a direct comparison of the alloys impossible and secondly since - although very small - there is disclosed a difference in the spreading ratio

of 0.2. Such difference in the spreading ratio is relevant since the data in Table 10 given for the spreading ratio vary only between 76.0 and 77.6 and hence a difference of 0.2 can be considered as representing a significant effect. The other Tables (8, 9, 11, 12, 13 and 14) in D6a also show such small variations in spreading ratio. Consistent therewith, the technical expert present at the oral proceedings confirmed that it was easier to determine an effect in the zero-cross time test than in the spreading test. Such confirmation means by reverse conclusion that a small effect in the spreading test may indeed be considered as significant.

9.8 The appellant further referred to the fact that D6 had been rejected by the Japanese patent office. A copy of the Notice for Rejection and the final rejection along with respective translations was submitted as E10. In the grounds for the rejection, the Japanese patent office stated that since "there is no comparative example with a sole addition of each of these minor elements of Ga, P, and Ni, it is not clear whether a combination of these elements in a small amount can result in any improvement over the prior art. Thus, the effect of the subject-matter is unclear." The assessment of the Japanese Patent Office although anyway not binding on the European Patent Office is not referring to the content of Ge, and accordingly, its rejection appears to be of no relevance in the given context.

9.9 Thus, claim 1 is not immediately allowable as it at least *prima facie* does not comply with the requirement of Article 56 EPC and - since this request was filed

only during the oral proceedings and thus was filed after the communication of the Board, thereby representing a further change of case, - this request was not admitted into the proceedings by the Board when exercising its discretion in accordance with Article 13(1) RPBA.

10. *Auxiliary request V*

10.1 The subject-matter of claim 1 of auxiliary request V was amended compared to previous requests so as to define a "use". It was further amended to specify wettability in terms of zero-cross time measured by a wetting balance test.

10.2 D2 can be considered as representing the closest prior art and suggests a lead-free alloy such as SnCu0.5-1 including 0.001 - 0.004% P. The finding that an addition of Ni with the aim of increasing strength and an addition of Ge with the aim of increasing wettability does not involve an inventive step has been assessed for the preceding requests above.

10.3 Accordingly, with regard to the test method for wettability which has been used to distinguish the claimed subject-matter further from the disclosure in D2, the problem to be solved when starting the assessment of inventive step from D2 can only be understood to concern the kind of wettability which should be considered in use.

Although the appellant argued that the problem to be solved was instead to provide a product which when used gave the desired wettability, the Board however does

not find this to be an objective problem in relation to the solution given by the subject-matter of claim 1, which is a claim formulated to the use of a product and not to the product itself.

10.4 According to the declarations of the appellant (and its technical expert), principally two kinds of tests for wettability exist.

(a) Wettability can be tested statically or in the long-term - by the spreading test - which is the test according to JIS Z 3198-3, submitted as E4. This test is used when evaluating whether a solder is suitable for solder connections where it is desired that the solder spreads and creeps into small cavities to provide good solder contact. Spreading is evaluated after a given time of typically 30 seconds and, accordingly, this test evaluates a relatively long-term or static behaviour of a solder alloy.

(b) In the alternative, wettability can be tested dynamically - which is the test according to JIS Z 3198-4, submitted as E3 and which was applied according to the declaration of the appellant's technical expert at the oral proceedings for evaluating the zero-cross time of the examples provided in the application in suit. In the wetting balance test, the velocity of wetting, expressed as zero-cross time, can be assessed. Such wettability test therefore evaluates the dynamic or short-term behaviour of a solder.

10.5 Also the appellant's technical expert confirmed that the skilled person would apply one of these two test methods when establishing the solderability/wettability of a specific alloy. Both test methods are standardized Japanese Industrial standard methods which therefore have to be considered as being well-known to the skilled person. Hence, wettability can be assessed by the skilled person either in terms of spreading or in terms of zero-cross time since for both possibilities well-known standard methods exist.

10.6 D6a discloses, in its Tables, test data concerning wettability in terms of spreading ratio - and thus concerning "static" wettability. These test data are obtained by the spreading test according to paragraph [0051]. According to the declaration of the appellant's technical expert the data were obtained in consistency with the method steps according to JIS Z 3198-3 (E4).

10.7 The view of the appellant was that when deciding which kind of wettability should be considered, the skilled person would be led by the test data disclosed in D6a to choose the test method determining "static" wettability according to E4 and there would be no hint for the skilled person to consider dynamic wettability.

10.8 In this context it is important to note that the general description of the invention refers to improved wettability without any suggestion as to which test method is to be used. Only in relation to the examples, does the description state that wettability of the solder alloys was tested by the wettability balance test and evaluated by the zero-crossing time

(paragraph [0032]). No explanation is given as to why this test was used or whether it would be preferred over any other test method, nor indeed how any particular alloy might perform in another test.

10.9 With regard to the different testing conditions, the results of both tests were alleged by the appellant not to be comparable since each test was designed to evaluate a different property of a solder alloy. However, no evidence was filed to demonstrate that these alternative test methods lead to a different evaluation concerning wettability of a solder. On the contrary, the effect of P on wettability is assessed as being positive in the spreading test of D6a as well as in the zero-cross time test of the application. Wettability is simply an inherent material property of the solder.

10.10 The Board accepts that wettability evaluated in terms of spreading is functionally different to wettability evaluated in terms of zero-cross time. However, the Board can only conclude that the skilled person had the choice between two JIS standard test methods to be used for assessing wettability. Their characteristics (dynamic versus static criteria) dictate the usefulness of the data for any particular application area and hence, their application depends on the desired/relevant characteristics of the soldering process (determination of spreading area for good solder contact and/or determination of contact time for fast connections). Therefore, there is no reason why the skilled person would hesitate to choose the more suitable test method when putting more emphasis on the timely character of the soldering action for the

connection than on the contact-area character thereof. As a consequence, even without any suggestion in D6 that the alternative wetting test method should be applied, the skilled person knew of their existence and characteristics and could apply the desired test method in view of the stated problem. Accordingly, such solution of the stated problem does not involve an inventive step (Article 56 EPC).

10.11 Although the appellant argued that the use was a different use in accordance with the case underlying G 2/88, the situation in G 2/88 is different from that of the case at issue, since it concerned a claim relating to a new use of a known compound reflecting a newly discovered technical effect whereas in the current case, claim 1 is directed to a known use of a known test method, albeit concerning a particular alloy composition.

10.12 Thus, claim 1 at least *prima facie* does not comply with the requirement of Article 56 EPC and is therefore not immediately allowable. Since this request was filed only during the oral proceedings and thus was filed after the communication of the Board, thereby representing a further change of case - this request was not admitted into the proceedings by the Board when exercising its discretion in accordance with Article 13(1) RPBA.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Patin M. Harrison