THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

This opinion (1) was not written for publication and (2) is not binding precedent of the Board.

Paper No. 31

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TOSIHIRO FUSAYASU, KENJI KAGATA, HIROTUGU YAMADA, ISAO KITAMURA, MASANOBU KOHARA, and MITSUYUKI TAKADA

Appeal No. 96-2821
Application 08/015,007

ON BRIEF

Before STONER, Chief Administrative Patent Judge, and FLEMING and TORCZON, Administrative Patent Judges.

TORCZON, Administrative Patent Judge.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

FINDINGS OF FACT

We have reviewed the record in its entirety in light of the arguments of Applicants and the examiner. Our decision presumes familiarity with the entire record. A preponderance of the evidence of record supports each of the following fact findings.

A. The nature of the case

1. Applicants appeal under 35 U.S.C. § 134 from the final rejection of claim 5. (Paper 22.) Claims 1-4 and 6-13 have been canceled. (Paper 16 at 1.)

2. Applicants filed the subject application on 9 February 1993. (Paper 1 at 1.) They claim the benefit under 35 U.S.C. § 119 of Japanese patent applications 4-026368, filed 13 February 1992, and 5-009106, filed 22 January 1993. (Decl. at 1.) The real party-in-interest is Mitsubishi Denki K.K. Applicants have not identified any other proceeding that might affect, or be affected by, this appeal. (Paper 30 at 1.)

3. The invention is entitled "Cu/Mo/Cu CLAD MOUNTING FOR HIGH FREQUENCY DEVICES". (Paper 10 at 1.) We presume that "Cu/Mo/Cu" has its ordinary meaning of a copper/molybdenum/copper laminate.

4. The subject matter of the claimed invention is a semiconductor having a **cer**amic **d**ual-**i**n-line **p**ackage (CERDIP) type of package. (Paper 1 at 1.) According to Applicants, "with the recent spread of data communication equipment[] using high frequency [gallium arsenide] GaAs devices, etc., an inexpensive semiconductor package with high heat transfer and suitable for high frequency devices has been increasingly demanded." (Paper 1 at 2-3.) They note that cost, temperature, weight, and ability to handle high frequencies are all problems in the art. (Paper 1 at 3.)

5. Applicants address the problems with the semiconductor package shown in Figure 4(a). They fabricate a base plate **11**

from a three-layer Cu/Mo/Cu-clad material. (Paper 1 at 5.) According to Applicants, "it is necessary to use the Cu/Mo/Cu clad material of thickness ratio from 1:3:1 to 1:5:1 so as to prevent the inadequate leak of the glass". (Paper 1 at 9; see also p. 8.) A leadframe **12** is fixed to the base plate **11** on one side and a window frame **15** on the other using a low-melting point glass **13**. Applicants disclose a cap **16** bonded to the window frame **15**. (Paper 1 at 7.) The specification recommends two properties for the glass **13**: a dielectric constant (,r) of 14 or less and a thickness (B) of "06." millimeters (mm) or more. (Paper 1 at 12.) The specification also states that "the thickness (B) of glass 13 between the base plate 11 and the window frame 15 [is] 0.6mm". (Paper 1 at 12.) Reading these two statements together, we understand the <u>total</u> thickness of the two glass layers **13** taken together is not less than <u>0.6</u> mm.

6. Claim 5, the only claim remaining in the application, reads as amended:

> A semiconductor package comprising:
> a base plate formed of a three layer Cu/Mo/Cu clad material for attaching to a semiconductor chip,
> a leadframe for receiving at least one lead, said leadframe being bonded by an adhesive to said base plate,
> a window frame surrounding the semiconductor chip and bonded by said adhesive to said leadframe, and
> a cap bonded to said window frame,
> wherein said adhesive has the dielectric constant of not more than 14 and a thickness of not less than 0.6mm.

B. Prior art

7. The examiner rejected claim 5 under 35 U.S.C. § 103 in view of the following references (Paper 16 at 2):

Matsumoto	JP (A) 1-273337[1]	published 1 Nov. 1989
Tokutake et al.	JP (A) 3-8362[1]	published 16 Jan. 1991
Iversen et al.	4,989,070	29 Jan. 1991
Mahulikar et al.	5,015,803	14 May 1991

A person having ordinary skill in the art would have apprehended the facts set forth in fact findings 8 to 20 at the time of the invention.

8. The Tokutake reference discloses a CERDIP[2] semiconductor package. The base **10** is "usually composed of conventional aluminum ceramic". (p. 3.) Leads **28** are aptly described as dual and in-line. (Fig. 1.) A window frame **12** is fixed to the base **10** and to a lead frame **14** using a low-melting point glass as the adhesive **18**. The lead frame is also bonded to a cap **16** using another low-melting point glass **20**. A semiconductor chip **26** is joined to the base **10**. (p.6.)

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[1] A copy of the English translation of this reference is attached. All references in this decision are to the translation unless otherwise indicated.

[2] The translator consistently mistransliterates ";OC^(/L_" (e.g., claim 1, line 2, in the original Japanese kokai application) as "therdip" instead of "CERDIP" throughout the translation.

9. Tokutake discloses neither the use of a Cu/Mo/Cu-clad base plate nor the thickness or dielectric constant for the adhesive **18**. Tokutake also uses a somewhat different ordering of the components.

10. The Mahulikar reference is concerned with semiconductor chip packages also. (1:5-10.) Mahulikar notes the thermal expansion deficiencies with CERDIP technology (2:61-68) and proposes his metal-clad base as a solution. (2:31-47.) His solution requires no changes in the existing manufacturing process.

11. "In accordance with the principles of [Mahulikar's] invention, the base **12** of the package **10** is a composite material composed of a first metal or metal alloy core layer **32** and first and second metal or metal alloy cladding layers **34**, **36**. The criteria for selecting the composition of the core layer and the cladding layers is that one of the metals has high thermal conductivity and a high thermal coefficient of expansion (TCE) and the other metal has a low thermal coefficient of expansion." (4:23-31.)

12. The "[p]referred high thermal conductivity metals include <u>copper</u>, aluminum, and alloys thereof". (4:39-46, emphasis added, parentheticals omitted.) "The second metal is selected to have a low thermal coefficient of expansion. An

exemplary listing of such metals includes alloy 42, Invar, and molybdenum." (4:52-58, emphasis added, parentheticals omitted.) Thus, random selection among the explicitly identified materials would yield a one-in-six chance of selecting a Mo/Cu/Mo clad base. Mahulikar also states that "the core layer **32** of the composite base **12** may comprise either the high expansion component or the low expansion component and the first and second clad layers **34** and **36** the other component." (6:15-19.) Thus, one would have a one-in-twelve chance of randomly selecting a Cu/Mo/Cu clad base if one were to apply the teachings of Mahulikar to a CERDIP system as suggested.

13. Mahulikar reports that molybdenum has drawbacks as a material (5:50-57), but nevertheless lists it as an "exemplary" metal (4:52-58).

14. Iversen discloses a heat sink comprising inserts **11** with substrates **10** on which semiconductor chips **38** are mounted. (2:26-30.) The heat sink has a very different geometry than a CERDIP-type package.

15. The substrate **10** must have a high thermal conductivity and a TCE that matches the semiconductor chip. Iversen recommends molybdenum, tungsten, or zirconium for the substrate **10**. (2:30-39.) The substrate **10** may be any desirable shape, but preferably has rounded corners to minimize stress on the

insulator **12**. The shape of the insulator **12** necessarily corresponds to the shape of the substrate **10**. (2:40-52.)

16. The rings **14** & **16** are fixed directly onto adjacent substrates. The insulator **12** bonds the two rings together. (2:42-59.) The rings are thin, glass-sealing, metal alloys. (3:10-15.) The insulator **12** is preferably glass. (3:5-6.) The TCE of the rings should roughly match the TCEs of the substrates **10** and the glass insulator **12**. (2:60-64.)

17. Iversen teaches that "[a]t high frequencies, e.g., microwave, the <u>thickness</u>, <u>dielectric constant</u>, loss tangent etc. of insulator **12** and the <u>geometry</u>, e.g., round, square, rectangular etc. of substrate **10** and rings **14**, **16** would be optimized to minimize power losses and to optimize the VSWR (Voltage Standing Wave Ratio) at the operating frequencies." (3:49-55, emphasis added.)

18. Iversen expressly teaches a thickness range for the insulator **12** of 0.003 inches (in.) to 0.030 in. (3:15-18.) This works out to be 0.0762 millimeters (mm) (=0.003 in. x 25.4 mm/in.) to 0.762 mm (=0.030 in. x 25.4 mm/in.).

19. The Matsumoto kokai publication lists a claim for a semiconductor package with a glass insulator having a dielectric constant of 8.0 or less. (p. 2.) Matsumoto notes that glass insulators in conventional semiconductor packages typically have

dielectric constants of 12.0 to 35.0. (p. 4.) He claims a lower dielectric constant because lower dielectric constants correlate to higher propagation rates for high-speed semiconductors. (p. 3.)

20. Matsumoto's package can have a ceramic substrate **1** (i.e., it can be a CERDIP). He uses glass as an adhesive to the substrate. (p. 5.) Glass is also used to encapsulate the leads **5** on top of the substrate **1**. (p.6.) Matsumoto uses glass and resin as his adhesive. (p. 7.)

21. We find the cited references to be indicative of the level of skill in the art. See In re GPAC, 57 F.3d 1573, 1579, 35 USPQ2d 1116, 1121 (Fed. Cir. 1995).

22. Applicants's claimed geometry, which surrounded and capped, presents a geometry very different than the geometry disclosed in Iversen. Iversen indicates that geometry is a critical factor in determining VSWR. (3:49-55.) Thus, the specific applicability of Iversen's insulator thickness is, at best, unknown. Iversen's general suggestion that one would optimize VSWR by adjusting thickness and dielectric constant does not help. (3:49-55.) Assuming, arguendo, that this suggestion extends to the claimed geometry, there is no evidence that optimization would produce the thickness and dielectric constant ranges that Applicants have claimed. Thus, we cannot find a

preponderance of evidence showing that a person having ordinary skill in the art would have arrived at the claimed thickness range of at least 0.6 mm based on the suggestions in Iversen as the examiner proposes. The remaining references do not cure this deficiency.

CONCLUSIONS OF LAW

A. Due process

1. Applicants argue that the examiner has deprived them of due process of law. (Paper 23 at 6-7.) The due-process argument is not stated with specificity,[3] but Applicants complain that the examiner has not adequately made all of the findings set forth in Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966). Assuming, arguendo, that a failure to make out an prima facie case of obviousness is a deprivation of due process under the Fifth Amendment to the United States Constitution, the constitutional dimension adds nothing to the otherwise routine analysis of the rejection. Since Applicants have not identified any uniquely constitutional dimension to their argument, we consider this issue as subsumed in their attack on the examiner's prima facie case.

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[3] For instance, we are left to assume that Applicants refer to the due-process requirement in the Fifth Amendment to the United States Constitution.

2. Applicants also argue that the examiner deprived them of due process when he changed the grounds of the rejection in his answer because he relies on only one reference in making the rejection. (Paper 25 at 1-2.) First, Applicants asked us to review the decision in the final Office action (Paper 22), which relies on all four of the cited references (Paper 16 at 2). Second, the answer expressly contains no new ground of rejection. (Paper 24 at 3.) While the answer's statement of the final rejection lacks a reference to three of the references (Paper 24 at 3), the remainder of answer relies on all four cited references. (See e.g., Paper 24 at 2, item (7) (listing all four references as "prior art of record relied upon in the rejection of claims [sic] under appeal") and at 4-5 (citing Mahulikar, Iversen, and Matsumoto).) Thus, Applicants could not reasonably have been led astray by the apparent misstatement in the answer. Indeed, in the same reply, Applicants complain that the examiner is improperly applying the other references. (Paper 25 at 3-5.) We conclude, therefore, that any error resulting from the misstatement of the final rejection was harmless.

B. Claim 5 is not obvious on the present record

3. The thickness of the adhesive is a contested limitation. The references on which the section 103 rejection is based do not teach or suggest the claimed thickness range for a

semiconductor package constructed as claimed. Fact finding 22, supra. We therefore will not sustain the rejection of claim 5 under section 103.

C. New ground of rejection: claim 5 is
based on an insufficient disclosure

4. We must give claims their broadest reasonable construction in light of the specification. In re Morris, 43 USPQ2d 1753, 1758 (Fed. Cir. 1997). We may not, however, read limitations into the claims from the specification. In re Van Geuns, 988 F.2d 1181, 1184, 26 USPQ2d 1057, 1059 (Fed. Cir. 1993).

5. If a claimed range includes substantially inoperative values, then the claim is properly rejected under 35 U.S.C. § 112. In re Corkill, 771 F.2d 1496, 1501, 226 USPQ 1005, 1009 (Fed. Cir. 1985). Claim 5 sets no limitation on the thickness ratio of the Cu/Mo/Cu clad layers, yet the disclosure states that a specific range is necessary:

> When the thickness ratio is 1:1:1, almost all of the packages are inadequate in leak. However, when the thickness ratio is 1:3:1-1:5:1, leak never occurs. The reason for this is supposed to be that, as shown in Fig. 8, the thermal stress to the glass is restricted to not larger than $2kg/mm^2$ when the thickness ratio is from 1:3:1 to 1:5:1, thereby preventing the glass 13 from leak.

(Paper 1 at 8, emphasis added; Fig. 8) On the next page, Applicants state:

> As described above, it is <u>necessary</u> to use the Cu/Mo/Cu clad material of the thickness ratio from 1:3:1 to 1:5:1 so as to prevent the <u>inadequate</u> leak of the glass 13, and therefore the thermal expansion coefficient should be in the range of 6.0-6.8($\times 10^{-6}/^{\circ}C$).

(Paper 1 at 9, emphasis added.)

6. Applicants have an obligation to claim their invention precisely. <u>Morris</u>, 43 USPQ2d at 1759. If the Cu/Mo/Cu thickness ratio is necessary, as the disclosure states with support from Figure 8, then it is also a necessary limitation in the claim; otherwise, the claim would encompass packages (e.g., with a Cu/Mo/Cu thickness ration of 1:1:1) that Applicants have identified as inadequate. We cannot cure this defect by reading the claim as limited to the disclosed subject matter. Therefore, we must reject claim 5 under section 112 for failing to claim the invention precisely.

DECISION

We reverse the rejection of claim 5 under section 103 because record lacks a preponderance of evidence to support a conclusion that the adhesive thickness limitation would have been obvious to a person having ordinary skill in the art.

We enter a new ground of rejection under section 112 because the claim fails to recite a limitation that Applicants have identified as a necessary part of the invention.

Any request for this Board to reconsider or modify this decision based upon the same record must be filed within one month from the date of this decision. 37 CFR § 1.197. If Applicants elect further prosecution of the new rejection under 37 CFR § 1.196(b) by amending the claim, by adding evidence to the record, or both, they must file a response within a shortened statutory period of two months from the date of this decision.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a). 37 CFR § 1.136(b).

REVERSED - 196(b) REJECTION

BRUCE H. STONER, JR., Chief Administrative Patent Judge	BOARD OF PATENT APPEALS AND INTERFERENCES
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