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**Datasheet for the decision
of 16 May 2013**

Case Number: T 2307/08 - 3.4.03

Application Number: 02796350.3

Publication Number: 1435102

IPC: H01G 9/00

Language of the proceedings: EN

Title of invention:

Tantalum capacitor with niobium alloy lead wire

Applicant:

Showa Denko K.K.

Headword:

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Relevant legal provisions (EPC 1973):

EPC Art. 56

Keyword:

"Inventive step (no)"

Decisions cited:

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Catchword:

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Case Number: T 2307/08 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 16 May 2013

Appellant:
(Applicant)

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Representative:

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Decision under appeal:

**Decision of the Examining Division of the
European Patent Office posted 2 June 2008
refusing European patent application
No. 02796350.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: G. Eliasson
Members: V. L. P. Frank
P. Mühlens

Summary of Facts and Submissions

- I. This is an appeal against the refusal of European patent application No. 02 796 350 for the reason of lack of inventive step.
- II. As final requests on appeal the applicant requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the original claims 1 to 5 and claims 6 to 8 filed on 13 October 2005.

Auxiliarily oral proceedings were requested.

- III. Claim 1 of this request reads as follows:

"A capacitor comprising two electrodes at least one of which is composed of tantalum or an alloy thereof and a dielectric material interposed between these electrodes, wherein an outgoing lead wire connected to the electrode is composed of a niobium alloy."

Claims 2 to 8 are dependent on claim 1.

- IV. The following documents are mentioned in this decision:

D1 = US 5 171 379 A

D2 = GB 2 185 756 A

- V. The examining division essentially argued that:

- The capacitor of claim 1 was distinguished from the one disclosed in D1 in that an outgoing lead wire

connected to the tantalum electrode was composed of a niobium alloy. This feature had the effect of reducing the embrittlement of the material used as lead wire during high temperature treatment. The problem could therefore be seen in improving the lead wire properties. The use of a niobium alloy lead wire did not involve an inventive step, since D1 disclosed to form an alloy to improve the mechanical properties (ie avoiding embrittlement) of the connecting wire. The skilled person would have followed these suggestions and used a lead wire based on niobium alloy for achieving the corresponding technical effect.

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

- The present invention related to a capacitor formed by a combination of tantalum or an alloy thereof as the electrode material and a niobium alloy as the material for the outgoing lead wire. The capacitor according to the present invention showed a combination of desired properties, namely excellent heat resistance without reducing the capacitance. Prior art lead wires used to be made of tantalum. Since tantalum was an expensive element, there was a demand for less expensive alternatives to tantalum. However, as disclosed in the present application, the heat resistance property of niobium was poor, while a further problem was low capacitance. In the present application, the term "*heat resistance*" was related to the deterioration of capacitor properties due to heat. The heat resistance was evaluated by measuring leakage current values of capacitors after

heating the capacitors in a reflow furnace. Hence, resistance to deterioration which was due to heat and resulted in an increased leakage current was expressed as "*heat resistance*" in the present invention. According to Comparative Examples of the present invention, leakage current values of tantalum electrode using a niobium lead were high and the capacitors using the electrode had insufficient heat resistance. Hence, the skilled person knew at the priority date of the present application that the use of a niobium lead resulted in the deterioration of capacitors. Such knowledge would have prevented him from using niobium as metal material for a lead. Moreover, the skilled person would not have expected to obtain a reduction in deterioration of capacitor properties due to heat by using a niobium alloy lead in a tantalum electrode. Despite of this prior art prejudice against the use of niobium, the present inventors found that the use of a lead wire of a niobium alloy in combination with electrodes of tantalum or an alloy thereof resulted in a capacitor having both high heat resistance and high capacitance.

- The technique of D1 related to a decrease in strength of the wire material after exposure to high temperature. D1 did not address heat-induced deterioration of capacitor properties, such as increase in leakage current. Hence, D1 did not relate to the same problem as the present invention. In addition, D1 did not teach the use of a combination of different metal materials between an electrode and a lead as defined in claim 1 of the present application, i.e. a tantalum electrode and a

niobium lead. Hence, D1 did not suggest the solution provided by the present invention. Rather the skilled person knowing the disadvantageous properties of niobium in terms of heat resistance would have been discouraged to use niobium.

- VII. In a communication pursuant to Article 15(1) RPBA annexed to the summons to oral proceedings, the board informed the appellant of its provisional opinion that the subject-matter of the independent claim of the sole request did not involve an inventive step.
- VIII. The appellant's representative announced with letter dated 15 April 2013 that they would not attend the oral proceedings. No observations on the board's provisional opinion were made.
- IX. Oral proceedings were thus cancelled.

Reasons for the Decision

1. The appeal is admissible.
2. *Inventive step (Article 56 EPC 1973).*
 - 2.1 It is undisputed that capacitors with at least one electrode composed of tantalum or a tantalum alloy and a lead wire composed of tantalum or a tantalum alloy were known from the prior art (D1, column 1, lines 12 to 25; D2, page 2, lines 43 to 45; present application, page 1, "Background art").

- 2.2 The capacitor of claim 1 differs from these conventional capacitors in that the outgoing lead wire connected to the electrode is composed of a niobium alloy.
- 2.3 The application discloses that the problem addressed by the invention is the provision of a tantalum capacitor with good heat resistance without reducing its capacitance. This is achieved by the use of a niobium alloy lead wire (page 2, last line to page 3, line 10).
- 2.4 Document D1 however discloses the advantageous properties of tantalum alloys as lead wires for tantalum capacitors (column 1, lines 12 to 38; in particular, lines 22 to 25). In particular, D1 discloses that, although reference was made solely to tantalum, niobium was also contemplated (column 1, lines 39 to 43). The skilled person thus understands from D1 that the advantageous properties of tantalum alloys could also be expected from corresponding niobium alloys.

Similarly, document D2 discloses the advantages of using tantalum alloy wires in tantalum electrolytic capacitors (page 1, lines 7 to 68; page 2, lines 42 to 48) and further discloses that, although the invention was described with reference to tantalum as the base metal, other Group V metals could be used, namely niobium and vanadium (page 2, lines 70 to 80). Hence also from D2 the skilled person understands that niobium alloy wires are expected to have similar properties as the disclosed tantalum alloy wires.

2.5 The board considers therefore that the skilled person would be motivated by documents D1 and D2 to try out niobium alloy lead wires in tantalum capacitors for achieving the advantageous effects disclosed in these documents for tantalum alloys, ie improving ductility and minimizing DC electrical leakage (D1, column 3, lines 8 to 11) and reducing embrittlement (D2, page 1, lines 62 to 68).

The skilled person would have thus made a capacitor having electrodes composed of tantalum or a tantalum alloy and a lead wire composed of a niobium alloy in an obvious manner.

2.6 The appellant applicant argued that a technical prejudice existed against using niobium wires in capacitors. It is however the established practice of the boards that the existence of a technical prejudice has to be proven by the applicant eg by reference to suitable technical literature (Case Law of the Boards of Appeal, 6th edition, I.D.9.2).

Even if such a prejudice would be accepted, it would be against using niobium in lead wires, but not against using a niobium alloy. Documents D1 and D2 point in the opposite direction from this alleged technical prejudice, namely the equivalence of tantalum and niobium when used in suitable alloys for making lead wires for tantalum capacitors

2.7 The appellant also argued that the problem addressed in the application was that of "heat resistance". This property being evaluated by measuring the leakage current values of the capacitors.

Document D1 however discloses that the tantalum alloy lead wires minimized DC electrical leakage. The skilled person would thus expect a similar effect from niobium alloy lead wires. The "*heat resistance*" improvement of the present application was thus foreseeable to the skilled person.

- 2.8 The board judges, for these reasons, that the capacitor of claim 1 of the sole request does not involve an inventive step within the meaning of Article 56 EPC 1973.

The appellant's sole request is thus not allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

Registrar:

Chair:

S. Sánchez Chiquero

G. Eliasson