

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [] To Chairmen
(D) [X] No distribution

**Datasheet for the decision
of 11 July 2008**

Case Number: T 0049/08 - 3.4.03

Application Number: 99303244.0

Publication Number: 0955642

IPC: H01C 7/00

Language of the proceedings: EN

Title of invention:
Formation of thin films resistors

Patentee:
MORTON INTERNATIONAL, INC., et al

Opponent:
-

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 56
EPC R. 27(1)(c)

Keyword:
"Inventive step (no) - main request"
"Remittal for further prosecution"

Decisions cited:
-

Catchword:
-



Case Number: T 0049/08 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 11 July 2008

Appellant:

MORTON INTERNATIONAL, INC.
100 North Riverside Plaza
Randolph Street at the River
Chicago,
Illinois 60606 (US)

Representative:

Bankes, Stephan Charles Digby
Baron Warren Redfern
19 South End
Kensington
London W8 5BU (GB)

Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 08. August 2007
refusing European application No. 99303244.0
pursuant to Article 97(1) EPC 1973.

Composition of the Board:

Chairman: R. G. O'Connell
Members: R. Q. Bekkering
T. Bokor

Summary of Facts and Submissions

I. This is an appeal against the refusal of application 99 303 244 for non-compliance with Rule 27(1)(c) EPC 1973, the description not being adapted to the claims.

II. At oral proceedings before the board, the appellant applicant requested that the decision under appeal be set aside and that a patent be granted in the following version:

Claims 1 to 12 according to the main request, or alternatively according to the auxiliary request, all submitted during the oral proceedings, with a description and drawings as on file.

III. Claim 1 of the main request reads as follows:

"1. An electrical resistor (400) comprising a layer of resistor material (401) on an insulating substrate (402) and means (403) at spaced-apart locations on said resistor material layer for electrical connection of said resistor material layer, said resistor material comprising a homogeneous mixture of between 95 and 99.5 wt.% of a zero valence metal, or an alloy of zero valence metals and between 5 and 0.5 wt.% of a dielectric material, characterised in that said resistor material layer has a thickness of 4 to 5000 nm".

IV. Claim 1 of the auxiliary request reads as follows:

"1. An electrical resistor (400) comprising a layer of resistor material (401) on an insulating substrate (402)

and means (403) at spaced-apart locations on said resistor material layer for electrical connection of said resistor material layer, said resistor material comprising a homogeneous mixture of between 95 and 99.5 wt.% of a zero valence metal or an alloy of zero valence metals and between 5 and 0.5 wt.% of a dielectric material, characterised in that said resistor material layer is deposited by combustion chemical vapour deposition (CCVD) or controlled atmosphere combustion chemical vapour deposition (CACCVD), the dielectric material being deposited generally homogeneously throughout the metal or metal alloy, either as single molecules or as nanoclusters of molecules".

V. Reference is made to the following prior art document:

D1: US 5 037 670 A.

VI. The appellant applicant argued as follows:

The claims according to both requests defined a novel and inventive product having regard to the disclosure of reference D1, which was silent as to the thickness of the layer of resistor material and in which there was no suggestion of using layers as thin as 5 micron or less. The maximum average particle size of 2 micron and the deposition methods mentioned suggested thicker layers than those of the present invention. Furthermore, according to the table at the top of column 3, the resistivities obtained were some two orders of magnitude less than the 17 ohms per square of example 1 of the application which, given the 80/20 ratio of metal to dielectric, was a surprising result, even

taking account of the lower resistivities of copper and nickel as compared to platinum.

The increased resistivity achieved according to the invention was believed to be attributable at least in part to the reduced thickness of the layer of resistive material as compared with those of D1. This could for example be obtained using the CCVD or CACCVD processes disclosed in the specification, which also give rise to the deposition pattern claimed in claim 8 of the main request and claim 1 of the auxiliary request.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request*
 - 2.1 *Novelty*

Document D1 discloses an electrical resistor comprising a layer of resistor material on an insulating substrate such as alumina (column 1, lines 6 to 20 and column 2, lines 41 to 43). The resistor material is eg formed by mixing a mixture of 80 % metal powder consisting of pure copper and pure nickel powders with 20 % borosilicate glass frit, followed by firing in a furnace. The pure copper and pure nickel powders have particle sizes between one and two microns (column 2, lines 21 to 66). Hence, the resistor material comprises a homogeneous mixture of about 80 wt % of an alloy of zero valence metals and about 20 wt % of a dielectric material.

However, there is no disclosure, at least no explicit one, in D1 of means at spaced-apart locations on said resistor material layer for electrical connection of said resistor material, as per claim 1.

Moreover, claim 1 differs from D1 in that the resistor material comprises a homogeneous mixture of between 95 and 99.5 wt % of a zero valence metal, or an alloy of zero valence metals and between 5 and 0.5 wt % of a dielectric material.

Finally, the thick film resistors to which D1 is related typically have thicknesses of the order of a few microns. No concrete thicknesses of the resistor material, though, are given in D1.

Accordingly, the subject-matter of claim 1 of the main request is new over D1 (Article 52(1) EPC and Article 54(1) and (2) EPC 1973).

2.2 *Inventive step*

2.2.1 In view of the differences between the subject-matter of claim 1 and D1 listed above, the objective problem to be solved relative to D1 is the selection of a number of concrete measures in terms of contacts, resistor material composition and thickness.

Concerning the means at spaced-apart locations on said resistor material layer for electrical connection of said resistor material, as per claim 1, it is noted that the provision of such means corresponds to the conventional way of forming a resistor. Accordingly it

would be obvious to the person skilled in the art to provide such means in the resistor of D1.

As far as the composition of the resistor material is concerned, in the board's judgement it lies within the normal experimental practice of the person skilled in the art to adjust the content of the metal (alloy) and the dielectric material, depending on the desired characteristics of the resistor. The effects of variations of the composition on these characteristics such as the resistivity of the resistor material etc. are easily verifiable. In particular the use of high(er) percentages of metal (alloy) of up to 99.5 wt %, typically providing a lower resistivity of the resistor material, would be obvious for electrical components, in particular in view of the general trend towards miniaturisation and multilayer integration with ever decreasing component sizes and layer thicknesses, requiring lower material resistivities.

Accordingly, the selection of compositions of the resistor material within the claimed range would be obvious to the person skilled in the art.

Finally, regarding the resistor material thickness, as noted above the general trend towards miniaturisation and multilayer integration would induce the skilled person to consider reduced thicknesses. The resistor material of D1 with particles of about 1 to 2 microns allows for layer thicknesses of a few microns, falling within the claimed range. Moreover, in the board's judgment D1 hints at the use of even smaller particles, making thinner layers possible, as this would ease firing (column 2, lines 44 to 48). Furthermore, the

skilled person would be aware that the thickness allows the resistance of the resistor to be adjusted to the needs of the application.

Thus, the selection of thicknesses for the resistor material within the claimed range would be obvious to the person skilled in the art.

The selections above do not provide any synergistic effect so that claim 1 merely provides an aggregation of obvious features.

- 2.2.2 The appellant argued that D1 suggested thicker layers than those claimed. Moreover, according to the table at the top of column 3 of D1, the resistivities obtained were some two orders of magnitude less than the 17 ohms per square of example 1 of the application which, given the 80/20 ratio of metal to dielectric, was a surprising result, even taking account of the lower resistivities of copper and nickel as compared to platinum.
- 2.2.3 However, in the board's judgement, as discussed above, the person skilled in the art would arrive at the claimed thicknesses by straightforward considerations.

The resistivities indicated in the table in column 3 of D1 and in example 1 of the application are expressed in Ohm/square and are in fact sheet resistances. These values depend in principle on the resistor material composition and the layer thickness. Since no thicknesses are provided in D1 and in the example of the application, any conclusions on the resistivity of the materials involved can only be speculative. It is

also noted that claim 1 is not limited to any particular resistivity.

Moreover, the person skilled in the art would in any event adjust the composition, and thereby the resistivity of the resistor material, depending on the required electrical characteristics, as a matter of normal practice, as discussed above. Document D1 in fact indicates that such resistivity adjustments are common and obtained by altering the material composition (column 3, lines 17 to 22).

- 2.2.4 Accordingly, the subject-matter of claim 1 of the main request lacks an inventive step within the meaning of Article 56 EPC 1973, contrary to the requirements of Article 52(1) EPC 2000.

Hence, the appellant's main request is not allowable.

3. *Auxiliary request*

- 3.1 Claim 1 of the auxiliary request includes the feature that the "*resistor material layer is deposited by combustion chemical vapour deposition (CCVD) or controlled atmosphere combustion chemical vapour deposition (CACCVD), the dielectric material being deposited generally homogeneously throughout the metal or metal alloy, either as single molecules or as nanoclusters of molecules*".

The appellant applicant referred to page 37, lines 9 to 22 of the original description as providing a basis for this amendment.

- 3.2 The board notes that this additional feature has not yet been examined by the examining division.

Furthermore, as the feature relates rather to the process used for forming the resistor material, doubts arise as to whether the feature has been the subject of a search. The board notes that despite the fact that the resistor material of the application is formed by CCVD or CACVD, none of the documents cited in the search report relate to such processes or even to conventional CVD providing at least a comparable type of material microstructure.

In fact, in view of the lack of unity objection raised by the search division, sweepingly confirmed by the examining division, none of the method claims were searched. The board, however, has doubts whether the finding of lack of unity between the product claims 1 to 18, for which a search was carried out, and at least the broadest form of a corresponding method of forming the product, see original claims 90 to 97, is justified.

Accordingly, the finding of lack of unity should be reviewed and, if necessary, the search should be completed.

In any case, an additional search concerning the above additional feature of claim 1 of the auxiliary request would appear indispensable, in order to allow a proper assessment of novelty/inventive step.

4. It is therefore appropriate that, pursuant to Article 111(1) EPC 1973, the case be remitted to the department of first instance for further prosecution.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance for further prosecution.

Registrar

Chair

S. Sánchez Chiquero

R. G. O'Connell