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SEARCH REPORT

Application Number
LH 22
LT 2020542

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
	LACK OF UNITY OF INVENTION see sheet B -----		INV. C23C18/16 C23C18/34
X	US 2005/194255 A1 (TIWARI CHANDRA S [US]) 8 September 2005 (2005-09-08) * paragraph [0010] * * paragraph [0024] * * paragraph [0030] - paragraph [0038] * * paragraph [0040] - paragraph [0049] * * paragraph [0059] * -----	1,2,4	C23C18/36 C23C18/18
X	EP 2 177 646 A1 (ATOTECH DEUTSCHLAND GMBH [DE]) 21 April 2010 (2010-04-21) * abstract * * paragraph [0016] - paragraph [0026] * * paragraph [0029] * -----	9,14,15,19	

TECHNICAL FIELDS SEARCHED (IPC)

C23C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 May 2021	Telias, Gabriela

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 11.08 (P04C80)

LACK OF UNITY OF INVENTION
SHEET B

Application Number
LH 22
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The Search Division considers that the present patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 9, 14, 15(completely); 1, 2, 4, 19(partially)

   Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, sodium hypophosphite, aminoacetic acid and sodium hydroxide.

   ---

2. claims: 11, 16(completely); 1, 2, 4, 19(partially)

   Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, morpholine borane, diethylenetriamine and sodium hydroxide.

   ---

3. claims: 12, 17(completely); 1, 2, 4, 19(partially)

   Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, dimethylamine borane, diethylenetriamine and sodium hydroxide.

   ---

4. claims: 13, 18(completely); 1, 2, 4, 19(partially)

   Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, sodium borohydride, ethylenediamine, potassium sodium tartrate, sodium thiosulfate and sodium hydroxide.

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5. claims: 3, 5-8, 10(completely); 1, 2, 19(partially)

   Method for the deposition of nickel on copper (two steps), wherein the activation bath comprises a reducing agent and a complexing agent.

The search has been limited to the first subject.

ANNEX TO THE SEARCH REPORT ON LITHUANIAN PATENT APPLICATION NO.

LH 22
LT 2020542

This annex lists the patent family members relating to the patent documents cited in the above-mentioned search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-05-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005194255 A1	08-09-2005	NONE	
EP 2177646 A1	21-04-2010	AT 503037 T	15-04-2011
		CN 102482779 A	30-05-2012
		EP 2177646 A1	21-04-2010
		JP 5665136 B2	04-02-2015
		JP 2012505964 A	08-03-2012
		KR 20110073512 A	29-06-2011
		MY 160304 A	28-02-2017
		TW 201029842 A	16-08-2010
		US 2011200842 A1	18-08-2011
		WO 2010043502 A1	22-04-2010

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WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
LH22	27.08.2020		LT2020542

International Patent Classification (IPC)
INV. C23C18/16 C23C18/34 C23C18/36 C23C18/18

Applicant
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This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of the opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

	Examiner
	Telias, Gabriela

Application number

WRITTEN OPINION

LT2020542

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable have not been examined in respect of

☐ the entire application

☒ claims Nos. 3, 5-8, 10-13, 16-18(completely); 1, 2, 4, 19(partially)

because:

☐ the said application, or the said claims Nos. relate to the following subject matter which does not require a search *(specify)*:

☐ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed *(specify)*:

☒ no search report has been established for the whole application or for said claims Nos. 3, 5-8, 10-13, 16-18(completely); 1, 2, 4, 19(partially)

☐ a meaningful opinion could not be formed as the sequence listing was either not available, or was not furnished in the international format (WIPO ST25).

☐ a meaningful opinion could not be formed without the tables related to the sequence listings; or such tables were not available in electronic form.

☐ See Supplemental Box for further details.

Box No. IV Lack of unity of invention

1. The requirement of unity of invention is not complied with for the following reasons:

   see separate sheet

2. This report has been established in respect of the following parts of the application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. (see Search Report)

WRITTEN OPINION

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	9, 14, 15(completely); 19(partially)
	No:	Claims	1, 2, 4(all partially)
Inventive step (IS)	Yes:	Claims	
	No:	Claims	9, 14, 15(completely); 1, 2, 4, 19(partially)
Industrial applicability (IA)	Yes:	Claims	9, 14, 15(completely); 1, 2, 4, 19(partially)
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

Re Item IV

Lack of unity of invention

1 It is considered that there are five inventions covered by the claims.

The reasons, for which the inventions are not so linked as to form a single general inventive concept, are as follows:

1.1 The common matter linking together the inventions is the following:

A method for the electroless deposition of nickel on a surface of a substrate made of copper or comprising a copper layer, wherein said method comprises the immersion of said substrate into at least one bath containing:

- a reducing agent selected from boron or phosphor-containing compounds, and
- a ligand suitable for complexing copper ions,

wherein said bath is suitable for the electroless deposition of nickel.

1.2 This common matter does not comprise a single general inventive concept, based on same or corresponding special technical features because D1 discloses a method comprising the features mentioned above (see D1: [0010], [0024], [0030] to [0038] and [0040] to [0049]).

Furthermore, the technical effect obtained by the method known from D1 corresponds to the one provided by the method described in the present application, namely, to enable the formation of a nickel layer on a copper surface without prior activation with palladium (see present application: page 5, 4th paragraph and D1: [0059]).

1.3 Document D1 also discloses some of the chemical compounds described in the present application (see specific examples provided in D1: [0024] and [0030] to [0038]), wherein this is an indication of lack of unity in the case of a Markush grouping.

1.4 When the Markush grouping is for alternatives of chemical compounds, they should be regarded as being of a similar nature where:

(i) all alternatives have a common property or activity, and

(ii) a common structure is present, i.e. a significant structural element is shared by all of the alternatives, or all alternatives belong to a recognised class of chemical compounds in the art to which the invention pertains.

Thus, common matter is provided for a Markush grouping by the common property or activity of the alternatives (see (i) above) and the common structure defined by (ii) above.

A "significant structural element is shared by all of the alternatives" if the compounds share a common chemical structure that occupies a large portion of their structures, or, if the compounds have in common only a small portion of their structures, the commonly shared structure constitutes a structurally distinctive portion and this structure or portion leads to a technical contribution in view of existing prior art at hand. The structural element may be a single component or a combination of individual components linked together.

There is no need for a significant structural element to be novel in absolute terms (i.e. novel per se). The term "significant" means that in relation to the common property or activity, there must be a common part of the chemical structure that distinguishes the claimed compounds from any known compounds having the same property or activity.

That is, the significant structural element defines the technical contribution which the claimed invention, considered as a whole, makes over the prior art at hand.

The alternatives belong to a "recognised class of chemical compounds" if there is an expectation from the knowledge in the art that members of the class will behave in the same way in the context of the claimed invention, i.e. that each member could be substituted one for the other, with the expectation that the same intended result would be achieved.

1.5 It follows that condition (ii) is not met for the present set of claims, that is, the alternatives of chemical compounds are not of a similar nature.

The claims are not linked by a technical relationship involving one or more same or corresponding special technical features, and consequently the application lacks a single general inventive concept.

Therefore, the application does not meet the requirement for unity of invention.

1.6 In view that a plurality of chemical compounds is applied for the different categories, namely as reducing agents and as complexing agents, a high number of different inventions could be defined, e.g. by defining an invention for each compound provided as complexing agent as well as for each compound provided as reducing agent.

1.7 The following groups were defined according to the different bath compositions, thereby limiting the number of inventions to the following:

I. Claims: 9, 14, 15 (completely); 1, 2, 4, 19 (partially)

Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, sodium hypophosphite, aminoacetic acid and sodium hydroxide.

II. Claims: 11, 16 (completely); 1, 2, 4, 19 (partially)

Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, morpholine borane, diethylenetriamine, and sodium hydroxide.

III. Claims: 12, 17 (completely); 1, 2, 4, 19 (partially)

Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, dimethylamine borane, diethylenetriamine, and sodium hydroxide.

IV. Claims: 13, 18 (completely); 1, 2, 4, 19 (partially)

Method for the deposition of nickel on copper (one step) using an electroless plating bath containing nickel sulfate, sodium borohydride, ethylenediamine, potassium sodium tartrate, sodium thiosulfate and sodium hydroxide.

V. Claims: 3, 5-8, 10 (completely); 1, 2, 19 (partially)

Method for the deposition of nickel on copper (two steps), wherein the activation bath comprises a reducing agent and a complexing agent.

Invention I

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1 US 2005/194255 A1 (TIWARI CHANDRA S [US]) 8 September 2005 (2005-09-08)

D2 EP 2 177 646 A1 (ATOTECH DEUTSCHLAND GMBH [DE]) 21 April 2010 (2010-04-21)

2 The present application does not meet the criteria of patentability, because the subject-matter of claim 1 is not new.

2.1 D1 discloses a method for the deposition of nickel on a surface of a substrate made of copper or comprising a copper layer, said method comprising a step wherein the substrate is immersed into a bath suitable for the electroless deposition of nickel, said bath containing a reducing agent selected from boron or phosphor-containing compounds and a ligand suitable for complexing copper ions (see D1: [0010], [0024], [0030] to [0038] and [0040] to [0049]).

The subject-matter of claim 1 is therefore not new.

2.2 D1 further discloses the subject-matter of claims 2 and 4 (see D1: [0030] to [0038]).

2.3 Dependent claims 9, 14, 15 and 19 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of inventive step, the reasons being as follows:

2.4 D2 is regarded as being the prior art closest to the subject-matter of claims 9, 14, 15 and 19 and discloses a plating bath for the electroless deposition of nickel on a copper surface, said plating bath containing:

- hypophosphite ions in a concentration comprised between 0.05 and 1.0 M,

- a complexing agent in a concentration comprised between 15 and 75 g/L wherein said complexing agent is selected from a list which includes glycine, and
- nickel in a concentration comprised between 0.02 and 0.3 M.

The pH of the nickel plating bath known from D2 is comprised between 3 and 6 and the temperature during plating is comprised between 70 and 95°C (see D2: abstract, [0016] to [0026] and [0029]).

2.5 The subject-matter of claims 9, 14 and 15 therefore differs from this known plating bath and corresponding plating method in that:

- the bath consists of four specific components, namely nickel sulfate, sodium hypophosphite, glycine and NaOH, and
- the pH adjustment is specifically achieved by addition of NaOH, while D2 provides a list of alternative compounds for adjusting the pH including NaOH (see [0026]).

2.6 There is no clear technical effect provided by the differences mentioned above: a nickel layer deposited on a copper surface is also obtained in the case of the method known from D2.

2.7 The problem to be solved by the present invention may therefore be regarded as how to provide an alternative bath for the electroless deposition of nickel.

2.8 It is considered that the selection of nickel sulfate, sodium hypophosphite and sodium hydroxide are straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to provide a plating bath for the electroless deposition of nickel.

Therefore, the subject-matter of claims 9, 14 and 15 cannot be considered to involve an inventive step.

2.9 Claim 19: the optimisation of parameters such as the concentration ranges and treatment times is considered to be within the scope of the customary experimental procedures which are followed by the skilled person.

Re Item VIII

Certain observations on the application

3 Claim 19 is not clear.

3.1 The expression "semi-automatic means" used in claim 19 is vague and unclear and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear.

4 The following typographical/grammatical errors are noted:

- Claim 1: "at least one of the mention(ed) bath(s) comprises a ligand"
- Claim 2: "wherein said ligand or the~~ir~~ mixture thereof consist of any water-soluble chemical compound~~s~~ capable of forming sufficiently stable complexes with copper ions, comprising, but ~~are~~ not limited to, amino acetic acid"
- Claim 15: "platting at 80-96°C"
- Claim 19: "wherein the concentration of the baths and/or process timing (is determined) ~~determinates~~ experimentally"