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C25D 13/02; C25D 1/00; C25D 1/16; C25D 3/562;
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(54) **SYSTEM AND METHOD FOR PRODUCING SUPERALLOYS UTILIZING ELECTROMETALLURGY**

- (57) A system and method for producing a rigid, heat-resistant part, such as a superalloy, via electrodeposition. The method can include the steps of coating a secondary alloy particulate with a superior alloy, forming a pre-coated particulate, dispensing a quantity of the pre-coated particulate into a container of an electrolytic solution, and applying a charge to the electrolytic solution such that the pre-coated particulate is electrodeposited onto a cathode or an external casing of the cathode. The pre-coated particulate can include particulate of non-uniform size and/or shape. The secondary alloy particulate is protected in the catalytic solution by the superior alloy coated thereon, such as nickel, iron, cobalt, and/or copper. The method also includes a step of vibrating or agitating the electrolytic solution before and/or during applying the charge to the electrolytic solution for even distribution of the pre-coated particulate onto the cathode or an external casing thereof.

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EUROPEAN SEARCH REPORT

Application Number

EP 24 15 8490

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 112 111 766 B (NANJING INST TECH) 13 July 2021 (2021-07-13)	1,2,7,9, 12-15	INV. C25D13/02
Y	* Sections Summary of the invention and Detailed ways * -----	3,4,6,8, 11	C25D1/16 C25D15/02 C25D1/00
X	RU 2 140 335 C1 (MATERIEHLZ INNOVEHJSHN INK [US]) 27 October 1999 (1999-10-27)	1,2,15	
Y	* the whole document * -----	3,4,6,8, 11	
X	US 2008/044685 A1 (JIN SUNGHO [US]) 21 February 2008 (2008-02-21)	1,2	
Y	* paragraphs [0027], [0032], [0033], [0036], [0037], [0040] * -----	3,4,6,8, 11	
X	JP 2017 188488 A (MITSUBISHI MATERIALS CORP) 12 October 2017 (2017-10-12)	1	
Y	* paragraphs [0012], [0017], [0024], [0039] * * claims 1,2 * -----	3,4	
Y	KRASI KOV A. V. ET AL: "Influence of Vibration Parameters during Electrodeposition of Ni-SiC Composite Coatings from a Vibration Stabilized Suspension", JOURNAL OF MACHINERY MANUFACTURE AND RELIABILITY, vol. 51, no. 4, 1 August 2022 (2022-08-01) , pages 300-305, XP093179194, Moscow ISSN: 1052-6188, DOI: 10.3103/S1052618822040100 Retrieved from the Internet: URL:https://link.springer.com/content/pdf/ 10.3103/S1052618822040100.pdf> * Sections Research methodology and Results and discussion * -----	3,4,6,8, 11	TECHNICAL FIELDS SEARCHED (IPC) C25D
-The present search report has been drawn up for all claims			

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Place of search

Date of completion of the search

Examiner

The Hague

3 July 2024

Le Hervet, Morgan

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

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

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

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

2-4, 7-9, 11-15 (completely); 1, 6 (partially)

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



LACK OF UNITY OF INVENTION **SHEET B**

Application Number

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

1. claims: 2-4, 7-9, 11-15(completely); 1, 6(partially)

A method for producing a rigid, heat-resistant part, the method comprising:dispensing a quantity of a pre-coated particulate into a container of an electrolytic solution, wherein the pre-coated particulate is a secondary alloy particulate coated with a superior alloy; and applying a charge to the electrolytic solution such that the pre-coated particulate is electrodeposited onto a cathode or an external casing of the cathode, wherein optionally the superior alloy is at least one of nickel, iron, cobalt, and copper. A system for producing a rigid, heat-resistant, complex-contoured part, the system comprising:a container with electrolytic solution sealed therein;an anode;a cathode;an electrical source electrically coupled to the anode and the cathode and configured for selectively applying a charge to the electrolytic solution via the anode and the cathode;a source of pre-coated particulate selectively dispensable into the container, wherein the pre-coated particulate includes a secondary alloy particulate coated with a superior alloy, wherein the superior alloy is at least one of nickel, iron, cobalt, and copper, wherein when the charge is applied to the electrolytic solution the pre-coated particulate is electrodeposited onto a surface of the cathode; and a vibrating device configured for applying a low frequency, high displacement resonance frequency to at least one of the container and the electrolytic solution sealed therein.

2. claims: 5, 10(completely); 1, 6(partially)

A method for producing a rigid, heat-resistant part, the method comprising:dispensing a quantity of a pre-coated particulate into a container of an electrolytic solution, wherein the pre-coated particulate is a secondary alloy particulate coated with a superior alloy; and applying a charge to the electrolytic solution such that the pre-coated particulate is electrodeposited onto a cathode or an external casing of the cathode, further comprising drawing partial vacuum from within the container during the step of applying the charge, such that hydrogen is removed from the container.

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82