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(88) Date of publication of the international search report:
23 September 2010

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(54) Title: METHOD OF MANUFACTURING A POROUS MAGNESIUM, OR MAGNESIUM ALLOY, BIOMEDICAL IMPLANT OR MEDICAL APPLIANCE

(57) Abstract: Method of manufacturing a porous metal or metal alloy structure having a predefined porosity for use as a biomedical implant or medical appliance. The method includes: mixing predefined amounts of a magnesium or magnesium alloy powder and a binder powder into a flowable powder mixture; providing a mould and injecting the flowable powder mixture into the mould to obtain a preform moulded into a desired shape. At least the binder is then allowed to solidify. Further the binder is removed from the preform to obtain a substantially binder-free preform. The substantially binder-free preform is then sintered during a time and at a temperature to achieve the predefined porosity. The method according to the invention can be further improved in that the magnesium or magnesium alloy structure is further provided with at least one substance that adds a predetermined functionality thereto.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. B22F3/11 C22C1/08 A61L27/04 A61L27/42 A61L27/54
A61L27/56

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B22F C22C A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 604 919 A (STERZEL HANS-JOSEF [DE] ET AL) 18 February 1997 (1997-02-18) abstract column 1, line 6 - line 19 column 2, line 15 - line 41 column 3, line 1 - line 54; example 1	1,4-8, 11-12, 15,47
X	US 5 064 463 A (CIOMEK MICHAEL A [US]) 12 November 1991 (1991-11-12) column 1, line 6 - line 10 column 2, line 18 - column 4, line 8 column 5, line 7 - line 18 claims 1-11; example	1,4-8, 15-18, 47-48,58

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 March 2010	28/07/2010

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 03/076109 A (ADVANCED CERAMICS RES INC [US]; ARTZ GREGORY [US]; VAIDYANATHAN RANJI) 18 September 2003 (2003-09-18) page 3, last paragraph - page 4, paragraph 5 page 6, paragraph 3 - page 7, last paragraph page 9, paragraph 2 - page 10, paragraph 2	1,4-6,8, 11-12, 16,58
X	WO 2008/087213 A (CINV AG [DE]; ASGARI SOHEIL [DE]) 24 July 2008 (2008-07-24)	1-2,4-8, 13-14, 16-18, 47-48
Y	abstract page 2, line 24 - page 7, line 8 page 7, line 20 - page 15, line 23 page 18, line 26 - page 20, line 21 page 20, line 23 - page 49, line 22 examples	3
Y	ZHANG X P ET AL: "Corrosion and wear resistance of AZ91D magnesium alloy with and without microarc oxidation coating in Hank's solution" JOURNAL OF MATERIALS SCIENCE, KLUWER ACADEMIC PUBLISHERS, BO, vol. 42, no. 20, 23 June 2007 (2007-06-23), pages 8523-8528, XP019528858 ISSN: 1573-4803 page 8523, right-hand column, line 1, paragraph 2 - line 5 page 8524, left-hand column, paragraph 2 figures 1-2,7; table 1 page 8526, right-hand column, paragraph	3
Y	FANYA JIN ET AL: "Bioactivity and corrosion behavior of magnesium alloys treated by plasma electrolytic oxidation" PLASMA SCIENCE, 2006. ICOPS 2006. IEEE CONFERENCE RECORD - ABSTRACTS. THE 33RD IEEE INTERNATIONAL CONFERENCE ON, IEEE, PI, 1 January 2006 (2006-01-01), pages 334-334, XP031035253 ISBN: 978-1-4244-0125-3 abstract	3

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	YONG HAN ET AL: "Structure and in vitro bioactivity of titania-based films by micro-arc oxidation" SURFACE & COATINGS TECHNOLOGY ELSEVIER SWITZERLAND, vol. 168, no. 2-3, 22 May 2003 (2003-05-22), pages 249-258, XP002572553 ISSN: 0257-8972 abstract page 249, right-hand column, last paragraph - page 250, left-hand column, line 1 page 250, right-hand column, last paragraph page 251, right-hand column, last paragraph - page 252, right-hand column, line 3 page 253, paragraph 3.3 - page 257, line 1 figures 5,10-11	3
X,P	CN 101 259 293 A (BINGZHE LI [CN]) 10 September 2008 (2008-09-10) abstract	1-2,4, 13-14,58
A	YEROKHIN A L ET AL: "Plasma electrolysis for surface engineering" SURFACE AND COATINGS TECHNOLOGY, ELSEVIER, AMSTERDAM, NL, vol. 122, 1 January 1999 (1999-01-01), pages 73-93, XP002992080 ISSN: 0257-8972 the whole document	3

INTERNATIONAL SEARCH REPORT

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-8, 11-18, 47-48, 58

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8, 11-18, 47-48, 58

   Method of making a porous metal (alloy) structure by means of injection moulding a mixture of a metal powder and a binder, removing the binder from the preform and sintering the binder-free preform, wherein Mg (alloy) is included in the metal powder and wherein optionally the structure is coated, wherein a plasma electric oxidation step may be used as the coating step

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2. claims: 9-10

   method of making a porous Mg (alloy) structure by means of injection moulding a Mg (alloy) powder and a binder and sintering the preform after dissolving the binder, wherein the binder is biodegradable.

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3. claims: 19-26(completely); 50-53(partially)

   method of making a porous Mg (alloy) structure by means of injection moulding a Mg (alloy) powder and a binder and sintering the preform after dissolving the binder, wherein a further substance is added for a further functionality to the structure be it by addition to the mixture or application before or after the sintering of the structure ;

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4. claims: 27-34(completely); 50-53(partially)

   method of making a porous Mg (alloy) structure by means of injection moulding a Mg (alloy) powder and a binder and sintering the preform after dissolving the binder, wherein a further substance is added for a further functionality to the structure by the addition of specific bio-active agents or drugs

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5. claims: 35-46, 49

   method of making a porous Mg (alloy) structure by means of injection moulding a Mg (alloy) powder and a binder and sintering the preform after dissolving the binder, whereby the morphology of the structure is controlled to provide mechanical and desorption properties for it to be useful as an implant.

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6. claims: 54-56

method of making a porous Mg (alloy) structure by means of injection moulding a Mg (alloy) powder and a binder and sintering the preform after dissolving the binder, wherein an insert of a different metal is added

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7. claim: 57

method of making a porous Mg (alloy) structure by means of injection moulding a Mg (alloy) powder and a binder and sintering the preform after dissolving the binder, whereby the moulding is performed on a roller to obtain a sheet-like preform.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2009/050473

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5604919 A	18-02-1997	NONE	
US 5064463 A	12-11-1991	NONE	
WO 03076109 A	18-09-2003	AU 2003228289 A1	22-09-2003
WO 2008087213 A	24-07-2008	AU 2008206952 A1	24-07-2008
		CA 2674812 A1	24-07-2008
		CN 101610740 A	23-12-2009
		EP 2104472 A1	30-09-2009
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CN 101259293 A	10-09-2008	NONE	