(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 501 539 A3**

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: **92200277.9**

(51) Int. Cl.5: **C22C 1/10**, C22C 1/09

(22) Date of filing: **03.02.92**

(30) Priority: **25.02.91 US 659967**

(43) Date of publication of application:
02.09.92 Bulletin 92/36

(84) Designated Contracting States:
DE FR GB

(88) Date of deferred publication of the search report:
08.09.93 Bulletin 93/36

(71) Applicant: **GENERAL MOTORS CORPORATION**
General Motors Building 3044 West Grand Boulevard
Detroit Michigan 48202(US)

(72) Inventor: **Gustafson, Thomas Wesley**
3780 Manistee Street
Saginaw, MI 48603(US)
Inventor: **Gerard, Dale Allen**
29859 E. Mackenzie Cir.
Warren, MI 48092(US)
Inventor: **Fick, Charles George, III**
5550 Cathedral Drive
Saginaw, MI 48603(US)
Inventor: **Sachdev, Anil Kumar**
809 Dressler Lane
Rochester, MI 48307(US)

(74) Representative: **Haines, Arthur Donald et al**
Patent Section 1st Floor Gideon House 28 Chapel Street
Luton, Bedfordshire LU1 2SE (GB)

(54) **Metal matrix composite composition and method.**

(57) A method of making a new metal matrix composite material formed from an aluminium-based alloy and a silicon carbide ceramic material is disclosed, in which preferably a porous pre-form (20) of the silicon carbide ceramic material having SiO_2 on the surfaces thereof is placed in an open-top die (24), heated to an elevated temperature in the range of 399 °C and 1093 °C, and impregnated under pressure with a molten alloy (27) comprising, by weight about 3 to 6 percent copper, about 0.5 to 5 percent magnesium and the balance essentially aluminium. The silicon carbide pre-form (20) impregnated with molten alloy is then cooled at a rate sufficient to sustain supersaturation of the copper and magnesium in the aluminium down to a predetermined temperature. The predetermined temperature is selected so as to permit precipitation in the alloy of a strengthening copper-rich secondary metallic phase containing copper, magnesium and aluminium and consisting essentially of about 40 to 80 percent by weight copper, magnesium in an amount between about 5 and 30 percent by weight, and the balance essentially aluminium. This results in the formation of a metal matrix composite material having a silicon carbide phase, an aluminium-rich primary metallic phase and a copper-rich secondary metallic phase which has the desired composition. The primary metallic phase can contain up to 10 percent of eutectic phase which is generally present as a coarse network or as isolated islands within the primary phase.

Preferably, cooling occurs immediately after the impregnating step and relatively rapidly to a temperature below about 288 °C, where precipitation of the secondary metallic phase occurs. Preferably, the secondary metallic phase comprises a cubically-shaped crystal structure which measures about 40 nanometres on a side.

EP 0 501 539 A3

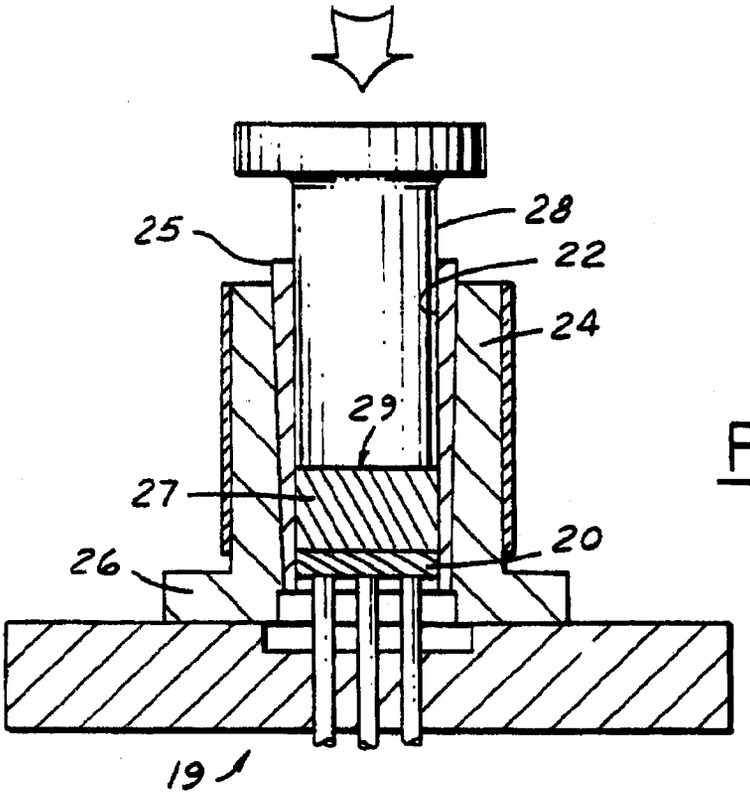

FIG.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 20 0277

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 375 473 (AUTOMOBILES PEUGEOT) * claim 1 * * page 3, line 31 * * page 4, line 2 * ---	1,10,20	C22C1/10 C22C1/09
A	EP-A-0 365 365 (HONDA) ---		
A	EP-A-0 236 729 (TOYOTA) ---		
E	CHEMICAL ABSTRACTS, vol. 117, no. 21, 23 November 1992, Columbus, Ohio, US; abstract no. 217673r, page 348 ; & SCR. METALL. MATER. vol. 27, no. 5, 1992, pages 617 - 622 SCHUELLER ET AL. 'Indentification of cubic precipitate observed in an Al-4.3Cu-2Mg / silicon carbide cast composite' -----	20	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

C22C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 JULY 1993	ASHLEY G.W.

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 03.82 (P0401)