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(54) **BIOCOMPATIBLE CEMENT CONTAINING REACTIVE CALCIUM PHOSPHATE NANOPARTICLES AND METHODS FOR MAKING AND USING CEMENT**

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C04B 12/02 (2006.01)

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(58) **Field of Classification Search** 106/690, 106/35

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,880,610	A	11/1989	Constantz	423/305
5,034,059	A	7/1991	Constantz	106/161
5,047,031	A	9/1991	Constantz	606/77
5,053,212	A	10/1991	Constantz et al.	423/305
5,129,905	A	7/1992	Constantz	606/76
5,149,368	A	9/1992	Liu et al.	424/602
5,336,264	A	8/1994	Constanz et al.	623/16
5,455,231	A	10/1995	Constantz et al.	514/21
5,496,399	A	3/1996	Ison et al.	106/35
5,522,893	A	6/1996	Chow et al.	623/11
5,525,148	A	6/1996	Chow et al.	106/35
5,542,973	A	8/1996	Chow et al.	106/35
5,545,254	A	8/1996	Chow et al.	106/35
5,569,442	A	10/1996	Fulmer et al.	423/311
5,571,493	A	11/1996	Fulmer et al.	423/308
5,605,713	A	2/1997	Boltong	427/2.1

(Continued)

FOREIGN PATENT DOCUMENTS

DE 19813614 A1 9/1999

(Continued)

OTHER PUBLICATIONS

K.E. Watons, et al., *The formation of hydroxyapatite-calcium polyacrylate composites*, J. of Materials Science in Medicine, 10:205-213 (1999).

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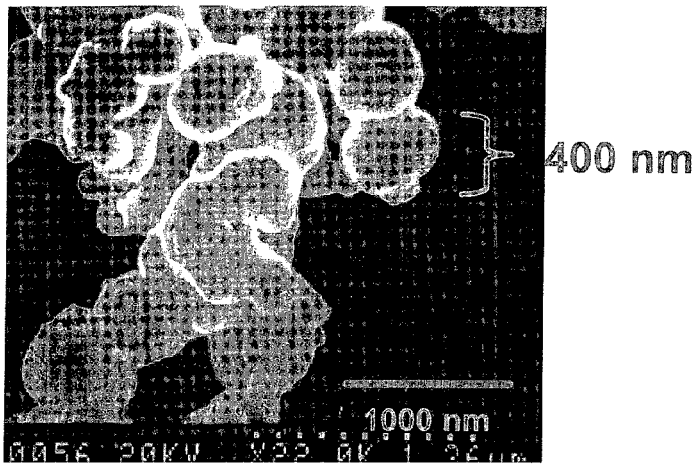
(57) **ABSTRACT**

A cement powder is disclosed that contains reactive tricalcium phosphate nanoparticles and other ingredients required to form a cementous material. Methods of making the reactive tricalcium phosphate nanoparticles, the cement powder, the cement paste, and cured cement are also provided, as are methods and articles for using the cement.

35 Claims, 7 Drawing Sheets