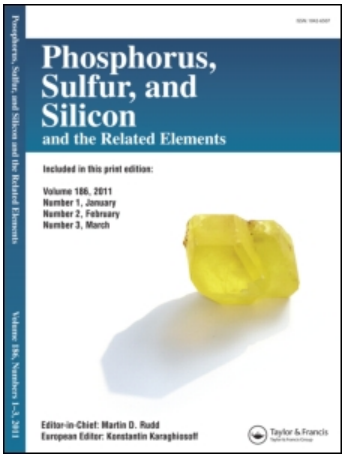

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Hydration and Hardening of Apatitic Cement

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HYDRATION AND HARDENING OF APATITIC CEMENT

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Hydroxyapatite (HAp) with the general formula $Ca_{10-z}(HPO_4)_z(PO_4)_{6-z}(OH)_{2-z}\cdot nH_2O$ has become of particular interest as a bio-restorative material having good compatibility with living hard tissues. In this work, hydration and hardening properties of water-setting apatitic cements were presented. $Ca_3(PO_4)_2$ with the form α (α-TCP) itself was an apatitic cement which could hydrate and harden alone, and formed HAp or $Ca_8H_2(PO_4)_6\cdot 5H_2O$ (OCP). Other apatitic cements were prepared by mixing at least two compounds selected from $CaHPO_4\cdot 2H_2O$ (DCPD), α-TCP, $Ca_4(PO_4)_2O$ (TeCP) and $CaCO_3$. The hydraulic reaction of α-TCP was accelerated by using water-soluble additives such as NaCl, NH_4Cl, NH_4-citrate, etc. Another way for the acceleration was the addition of DCPD. The combination α-TCP/DCPD was developed with the expectation of the reaction α-TCP + DCPD + $H_2O \rightarrow$ 1/2 OCP. Hydraulic reactions of combinations TeCP/DCPD (Brown and Chow, 1983) and DCPD/$CaCO_3$ were also investigated. Various setting times above 4 min were obtained at 37-40°C by using different additives and combinations. The setting and hardening was considered to be due to the entanglement of HAp or OCP microcrystals formed on original powder particles. The resulting porously hardened bodies had porosities of 46-80%, compressive strenghts of 2-30MPa, diametral tensile strengths of 0.1-3.5MPa. These apatitic cement pastes showed different DSC characteristics;α-TCP:exothermic peak at 70-105°C,α-TCP/DCPD:two exo. and two endothermic peaks in the range of 40 to 120°C, TeCP/DCPD:two exothermic peaks in the range of 30 to 80°C, and DCPD/$CaCO_3$:endothermic peak at 70-100°C.