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Wollastonite (CaO.SiO2) glass-ceramic by sinter-crystallization

Daguano, J.K.M.F. (1); Soares, V.O. (1); Bianchin, O.S. (1); Gonçalves, L.M.G.

(1); Zanotto, E.D. (1)

(1) UFSCar

Wollastonite has been studied as a material for artificial bone and dental restoration because of its bioactivity and biocompatibility. This phase presents acicular crystals, which could, in principle, increase the toughness of glass-ceramic implants. But glasses based in the CaO.SiO2 system present preferential surface crystallization, which precludes the production of glassceramics by the traditional method of internal nucleation and growth, unless one finds a powerful nucleation agent (not known at this time. An alternative route to produce glass-ceramics is by sintering powdered glass. In this method the glass particle surfaces induce crystallization during sintering and no nucleating agents have to be added to the precursor glass. In this work, glass-ceramics having wollastonite as the main phase have been produced by viscous sintering with concurrent crystallization. Different heating hates (10^o-40°C/min) and final sintering temperatures (700-1000°C) were used. Microstructure, residual porosity, hardness and indentation toughness (Kc) were evaluated for each sample. We produced a glass-ceramic with 5-8% residual porosity, hardness of 6-8 GPa and indentation toughness of 1.8-2.2 MPa.m1/2. This value of Kc represents an increase of about 150% when compared with the Kc of the parent glass (~ 0.8 MPa.m1/2).