Sintering and mechanical properties of MgO-doped nanocrystalline hydroxyapatite

C.Y. Tan, A. Yaghoubi, S. Ramesh, S. Adzila, J. Purbolaksono, M.A. Hassan, M.G. Kutty

Abstract:

Hydroxyapatite (HA) has been extensively studied for its exceptional ability in promoting osseointegration as in bone graft substitute and biomimetic coating of prosthetic implants. However poor mechanical properties of HA, in particular its low fracture toughness, has made its widespread adaption in a number of biomedical applications challenging. Here we employ an optimized wet precipitation method to synthesize nanocrystalline HA with significantly improved mechanical properties. In addition doping by MgO is found to effectively suppress grain growth and enhance fracture toughness by nearly 50% while good densification and phase stability in all samples regardless of concentration of dopant are fully maintained. Microstructural analysis further suggests that the exceptionally superior mechanical properties can be explained by migration of MgO to grain boundaries where they transform the more common transgranular fracture into an intergranular mode. Our biodegradation tests also confirm that MgO-doped HA is indeed a suitable candidate for load bearing implants.

Keywords:

C. Mechanical properties; Hydroxyapatite; Sinterability; Synthesis; Relative density

Published In:

Ceramics International , vol.39,Issue 8 , PP.8979-8983