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Mechanical properties of microwave sintered 60YSZAl_2O_3/ 10HAP bioceramics composites

Abstract

Microwave heating technology promising shorter processing times and less energy consumption beneficial for economic perspective with improved properties and better microstructural control. This study focussed on microwave sintered bioceramics material of 60YSZAl_2O_3/10HAP mixture fabricated by powder metallurgy route. The study was conducted based on three different sintering temperatures, starting with 900˚C, 1000°C ended with 1100°C. Mechanical properties of materials such as porosity, density, hardness and compressive strength were then determined for each composites. Results showed that lowest porosity was obtained at 1000°C which promoting to higher density, hardness and compressive strength. However, the increasing sintering temperature up to 1100 ˚C was initiated the decomposition of HAP and constitutes the formation of $CaZrO_3$ determined by X-ray Diffraction (XRD) analysis. Microstructure characterization by Scanning Electron Microscope (SEM) observed the growth of large particles and pores result in excessive grain coarsening. Better sinterability was achieved through an adequate sintering temperature of 1000°C with no reaction reported between HA and ZrO_2 during the sintering process facilitate by microwave hybrid heating. The pores was found to be interconnected for each composites via microwave heating expected to be useful for biomedical application which was favorable to osteo-integration.

Keywords; Alumina; Hydroxyapatite (HA); Microwave Sintering; Yttria-Stabilized Zirconia