

The effect of manganese oxide on the sinterability of hydroxyapatite

Abstract

The sinterability of manganese oxide (MnO_2) doped hydroxyapatite (HA) ranging from 0.05 to 1 wt% was investigated. Green samples were prepared and sintered in air at temperatures ranging from 1000 to 1400 °C. Sintered bodies were characterized to determine the phase stability, grain size, bulk density, hardness, fracture toughness and Young's modulus. XRD analysis revealed that the HA phase stability was not disrupted throughout the sintering regime employed. In general, samples containing less than 0.5 wt% MnO_2 and when sintered at lower temperatures exhibited higher mechanical properties than the undoped HA. The study revealed that all the MnO_2 -doped HA achieved >99% relative density when sintered at 1100–1250 °C as compared to the undoped HA which could only attained highest value of 98.9% at 1150 °C. The addition of 0.05 wt% MnO_2 was found to be most beneficial as the samples exhibited the highest hardness of 7.58 GPa and fracture toughness of $1.65 \text{ MPam}^{1/2}$ as compared to 5.72 GPa and $1.22 \text{ MPam}^{1/2}$ for the undoped HA when sintered at 1000 °C. Additionally, it was found that the MnO_2 -doped samples attained E values above 110 GPa when sintered at temperature as low as 1000 °C if compared to 1050 °C for the undoped HA.