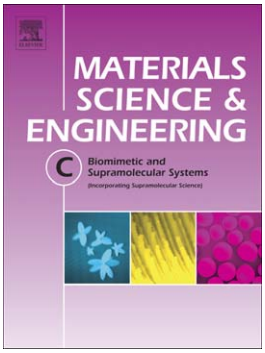

Pressureless sintering and mechanical properties of hydroxyapatite/functionalized multi-walled carbon nanotube composite

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Pressureless sintering and mechanical properties of hydroxyapatite/functionalized multi-walled carbon nanotube composite

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Abstract

This work aims to study the optimum sintering conditions of hydroxyapatite/functionalized multi-walled carbon nanotube (HA/f-MWCNT) composite with improved mechanical properties for bone implant applications using a pressureless sintering technique. The carboxyl functional group (–COOH) introduced by the acid treatment on the MWCNT surface by which HA molecules are grafted onto the surface of functionalized MWCNT with strong interfacial bonding. The composite exhibits a lower hemolytic rate of 1.27%. The flexible nature of f-MWCNT makes them bend and attached to the HA grains, indicates that f-MWCNT bear significant stress by sharing a portion of the load and it leads to improve their mechanical properties. The maximum Vickers hardness of 3.6 GPa is obtained for the HA/f-MWCNT composite sintered at 1100 °C, whereas the highest compressive strength of 481.7 MPa and fracture toughness of 2.38 MPa.m$^{1/2}$ is achieved after sintering at 1150 °C. This study demonstrated that HA/f-MWCNT composite create suitable structures by vacuum pressureless sintering technique to satisfy the mechanical requirements for bone tissues.

Keywords: Hydroxyapatite, Carbon nanotube, Pressureless sintering, Hemocompatibility, Mechanical properties