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Effect of sintering on the physical and mechanical properties of Co-Cr-Mo (F-75)/HAP composites

Abstract

This paper reports on the effects of HAP addition and sintering temperature on the microstructure and properties of the F-75/HAP composites fabricated by powder metallurgy.Co-Cr-Mo (F-75) is used in orthopedics because of its excellent biocompatibility when implanted to human or animal body. Hydroxyapatite (HAP) powders have been used as fillers because HAP is the one of the most effective biocompatible materials with similarities to mineral constituents of bones and teeth. HAP powders (chemical formula $Ca_{10}(PO_4)_6(OH)_2$) have been added to Co-Cr-Mo alloys in composition of 0 to 10 wt. %. The mixtures were then milled, cold compacted at 550 MPa, before sintered at 1100 and 1200°C in a tube furnace. The density, porosity, microhardness and compressive strength were measured. The composites that have been sintered at temperature 1200°C showed better physical and mechanical properties than those produced at 1100°C. After sintering at 1200°C, the samples show higher density, compared with the sample sintered at 1100°C. The sample with no HAP which have been sintered at 1200°C has the highest microhardness (208.9 HV), compared with the same sample sintered at 1100°C (194.3HV). As the temperature is increased from 1100 to 1200°C, the value of compressive strength increased from 184.538 to 341.086 MPa. Microstructural analysis for line scan showed that, as the sintering temperature was increased, there was good interface bonding between HAP particles and matrix F-75.

Keywords

Co-Cr-Mo alloys; Hydroxyapatite; Mechanical properties; Physical properties; Sintering