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Title: Structure-property relationships of iron-hydroxyapatite ceramic matrix nanocomposite fabricated using mechanosynthesis method

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Abstract: Hydroxyapatite (HAp) is an attractive bioceramics due to its similar composition to bone mineral and its ability to promote bone-implant interaction. However, its low strength has limited its application as load bearing implants. This paper presented a work focusing on the improvement of HAp mechanical property by synthesizing iron (Fe)-reinforced bovine HAp nanocomposite powders via mechanosynthesis method. The synthesis process was performed using high energy milling at varied milling time (3, 6, 9, and 12 h). The samples were characterized by X-ray diffraction (XRD), Fourier transform infrared (FT-IR), and scanning electron microscopy (SEM). Its mechanical properties were investigated by micro-Vicker's hardness and compression tests. Results showed that milling time directly influenced the characteristics of the nanocomposite powders. Amorphous BHAp was formed after 9 and 12 h milling in the presence of HPO4 2 - ions. Continuous milling has improved the crystallinity of Fe without changing the HAp lattice structure. The nanocomposite powders were found in spherical shape, agglomerated and dense after longer milling time. The hardness and Young's modulus of the nanocomposites were also increased at 69% and 66%, respectively, as the milling time was prolonged from 3 to 12 h. Therefore, the improvement of the mechanical properties of nanocomposite was attributed to high Fe crystallinity and homogenous, dense structure produced by mechanosynthesis