Crystallization behavior of low-cost biphasic hydroxyapatite/β-tricalcium phosphate ceramic at high sintering temperatures derived from high potential calcium waste sources

ABSTRACT

This paper reported the formation of biphasic hydroxyapatite, (HA) and β-tricalcium phosphate, (β-TCP) sintered at various sintering temperature from waste material. The phase stability of HA ceramic was investigated by imposing the high sintering temperature in order to study the transformation of the single phase of HA to biphasic HA/β-TCP ceramic. The evolution microstructure of HA and biphasic HA/β-TCP ceramic was studied at various sintering temperature reach up to 1400 °C. The single phase of HA was observed from 200 to 1200 °C and the secondary phase β-TCP appears due to the decomposition of partial HA at 1300-1400 °C. The optimum temperature for a single phase of HA was identified after sintering at 1200 °C to produce HA with high mechanical hardness about 5.11 GPa. This is clearly related to the phase stability and morphology of HA. The particles size of HA as-synthesized were recorded in nano range scale at ~9 to 20 nm. However, the average particle sizes become larger and compact between ~0.21 and ~3.3 μm from 600 to 1200 °C. Thus, the sintering temperature gives an impact on the phase stability, microstructure and microhardness of HA derived from high potential waste sources.

Keyword: Hydroxyapatite; β-tricalcium phosphate; Biphasic; Crystallization; Sintering