Cold Sintering Process for developing hydroxyapatite ceramic and polymer composite

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Cold sintering process (CSP) is a non-conventional, low-energy sintering technique that promotes the densification of ceramics in the presence of transient liquids under low temperatures (≤300°C) and pressures (≤500 MPa). Additionally, it provides a new strategy for the co-sintering of ceramic and polymers into a single system which is not feasible through conventional methods. Exploiting the advantages of cold sintering, this investigation has aimed to densify the hydroxyapatite (HA) at nanoscale as well as the co-sintering of HA/polylactic acid (PLA) based composite for bone regeneration applications. The importance of liquid phase chemistry in cold sintering of HA was assessed using water, acetic acid, and phosphoric acid as liquids. The changes in relative density was observed with respect to the nature of liquid/ionic concentrations (0.5M, 1.0M, & 2M). In the case of composites, the influence of different compatibilizers on the homogeneous integration of HA/PLA composite was examined. Eventually, this study contributes critical fundamental knowledge pertaining to the development of dense HA ceramics and polymer composites. Specifically, it underscores the importance of liquid phase chemistry in the cold sintering of HA as well as the influence of compatibilizers in co-sintering of HA/PLA composites.