Student Speech Contest 2024

Going non-conventional - Cold Sintering Process for developing hydroxyapatite ceramic and polymer composites

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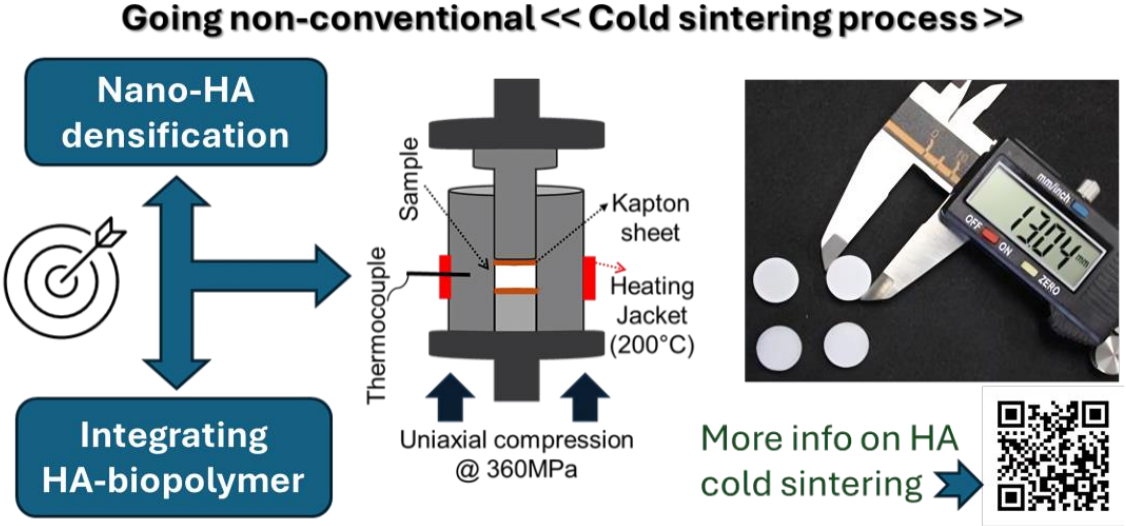
Project: Cold sintering process to develop bio-active cermics and composites for biomedical application



Abstract

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). This low-temperature consolidation additionally 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 the 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 were observed concerning the nature of liquid/ionic concentrations (0.5M, 1.0M, & 2M). The cold-sintered HA samples were characterized with relevant techniques to unveil the chemical and microstructural features to understand the impact of liquids. In the case of composites, the influence of pressure, and different compatibilizers on the homogeneous integration of HA/PLA composite was examined. Further characterizations like mechanical testing are underway to explore the integration mechanisms and interfacial bonding between HA and PLA. Eventually, this study contributes to underscore the critical fundamental knowledge on the development of dense HA ceramics and polymer composites.