

Field-assisted sintering of biocompatible lithium sodium potassium niobate piezoceramics for bone regeneration

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Piezoelectric materials have gained significant attention in the bioceramics research community. They can promote cell-material interactions that enhance bone tissue regeneration. However, conventional piezoceramics often face challenges such as cytotoxicity, degradation under physiological conditions, and difficulty achieving high density and functionality at low sintering temperatures. We demonstrated the successful synthesis of highly dense lithium sodium potassium niobate (LNKN) ceramics (~98.3% density) at a low sintering temperature of 825 °C using field-assisted sintering technology, exceeding the density of the conventionally sintered sample (~94% at 1060 °C). It is particularly advantageous for minimizing alkali volatilization, and enabling co-sintering with temperature-sensitive materials. The resulting LNKN showed a strong dependence of phase transformations between coexisting crystal structures on the sintering conditions. Grain growth was also controlled, and the enhanced hardness and a significant piezoelectric (~133.15 pm/V) response were observed. Piezoresponse force microscopy measurements on polarized and unpolarized surfaces also reveal that pre-osteoblast (MC3T3-E1) cell attachment was enhanced on polarized surfaces, and that individual cells simultaneously interacted with multiple regions of opposite polarity. These insights reveal a strong potential for LNKN, offering possibilities for control over material performance and promoting bone regeneration.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

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Invitation letter for visa

No

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