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Assessing the Bioactivity and Cell Viability of Apatite-Wollastonite Glass Ceramics Prepared via Spray Pyrolysis

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Abstract : In this study, we examined the sinterability and bioactivity of MgO-SiO_2-P_2O_5-CaO-CaF_2 glass compositions created through spray pyrolysis. We evaluated the bioactivity of the materials by immersing them for varying periods of time in simulated bodily fluid (SBF) and found that bioactivity was related to the sintering temperature and soaking time. The material's pH value during immersion in SBF was within the range of 7.4-8.2, which is below 8.5 and improves compatibility and reduces toxicity in biological applications. We used X-ray diffraction and scanning electron microscopy to determine the phase compositions and morphologies of the samples and found that the 1100°C sintered A-W GC sample exhibited the highest bioactivity after soaking in SBF. This sample was dominated by fluorapatite, wollastonite, and whitlockite crystals scattered throughout the glass matrix. The crystallinity (%) of the A-W GC increased as its bioactivity improved, making it more suitable for use in pharmaceutical applications. We also conducted a cytotoxicity test on A-W GC samples sintered at different temperatures and found that the glass-ceramics were non-toxic to MC3T3-E1 cells at all extraction concentrations, except for those sintered at 700°C at concentrations of 250, 200, and 150 mg/ml where cell viability (%) was below the threshold of 70%.

Keywords : apatite wollastonite glass ceramics, bioactivity, calcination, cell viability
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