Evaluation of microstructural and thermal properties of sol-gel derived silica-titania based porous glasses

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Abstract:

In recent years, the synthesis of sol-gel derived porous glasses has drawn widespread attention owing to the convenience and versatility of the sol-gel method. The sol-gel synthesis process mainly involves hydrolysis and condensation of precursors followed by drying and stabilization. The characteristics such as pore structure, morphology and compositions of sol-gel derived glasses significantly affect their final properties. In the present study, silica-titania (Si-Ti) based porous glasses with different compositions were synthesized using the sol-gel method. Metal alkoxides such as tetraethoxysilane (TEOS) and titanium isopropoxide (TIP) were used as a source as the source for silica and titania respectively. Nitric acid (HNO3) was used as catalysts to trigger the hydrolysis reaction and polyethylene glycol (PEG) was used as a polymeric component to induce phase separation. The influence of different processing parameters on the microstructural and thermal properties was investigated. The microstructure of the synthesized Si-Ti based porous glasses was investigated using Scanning electron microscopy (SEM) and the thermal characteristics were evaluated using thermogravimetric analysis (TGA) and thermomechanical analysis (TMA). The main objective of this study is to ascertain the application of sol-gel derived Si-Ti porous glasses as a potential biomaterial for bone tissue regeneration. To understand this facet of Si-Ti porous glasses, the biological performance will be investigated and their porous architecture will be explored in relation to their interaction with the bioactive nanoparticles.

Key words:

Sol-gel method, Si-Ti glasses, microstructure, thermal properties