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Phase composition, microstructure, and mechanical properties of polymer-derived SiOC glass-ceramics reinforced by WC particles

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Statement of the Problem: The design and preparation of ceramic materials are closely related to the development of modern industry. In this work, a tungsten carbide (WC)-containing silicon oxycarbide (SiOC) glass-ceramic was prepared from WC-filled polysiloxane via pyrolysis and subsequent spark plasma sintering (SPS). The sintering behavior of SiOC was investigated by monitoring the densification temperature and shrinkage displacement. The phase composition and microstructure of ceramics were characterized by using FTIR, XRD, SEM, Raman spectrum, and optical microscope. It was shown that upon increasing the sintering temperature from 1400 °C to 1600 °C, the densification of ceramics was further improved, and the disorder of free carbon in SiOC was linearly decreased with sintering temperature. In addition, it was found that the incorporation of WC particles was effective to reinforce the mechanical properties of ceramics, and relevant strengthening mechanisms were discussed here. Finally, a correlation between phase composition, microstructure, and macroscopic performances of SiOC glass-ceramics was successfully derived.

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