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Effect of preparation parameters on the properties of unidirectionally SiC-fibre reinforced MAS and BMAS glass-ceramics

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Abstract

The objective of the paper is to investigate the possibilities of fibre reinforced glass ceramics based on cordierite (MAS = Mg-Al-silicate) and Ba-osumilith (BMAS = Ba-Mg-Al-silicate) and to find optimum preparation conditions with respect to mechanical properties, particularly to high strength and toughness values. The prepregs were prepared by the sol-gel-slurry method, the composites by application of the most effective densification conditions via the molten and high-viscosity state and by crystallization under various temperature-pressure-time programs. Best properties are obtained in the system BMAS with 14 wt.-% BaO at a relatively low SiC-fibre content of 20 to 30 vol-% (strength: 534 MPa, work of fracture: 16 kJ/m^2). Larger values of strength are obtained with a predominant glass phase (up to 900 MPa) but those composites have only low application temperatures. Here, the optimum fibre concentration is much higher (about 50 vol.-%) than in the crystallized composites. The lower optimum fibre content of the predominantly crystallized composites is a consequence of a different phase composition and micro-structure of the matrix as compared to that without the presence of the fibres under the same thermal and pressure conditions.