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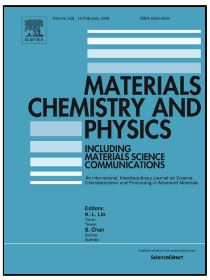

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The Effect of CeO_2 on the Crystallization of MgO-Al_2O_3-SiO_2-ZrO_2 Glass

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Abstract

Glasses with the mol% composition of $21.2\,MgO{\cdot}21.2\,Al_2O_3{\cdot}51.9\,SiO_2{\cdot}5.7\,ZrO_2$ were doped with 0.5 mol% CeO_2 and analysed concerning their crystal phases and microstructure after a one- as well as a two-step crystallization treatment. X-ray diffraction studies indicate the presence of tetragonal ZrO_2, a high-/low-quartz solid solution and spinel which were also obtained in the glass-ceramics without CeO_2 and are essential for the good mechanical properties of the glass-ceramics. However, the X-ray diffraction results show an increase of the concentration of the desired crystal phases low-quartz solid solution and spinel with the addition of CeO_2 to the glass composition. As shown by X-ray absorption near edge spectroscopy and optical spectroscopy, Ce occurs mainly in the valence state +3. Only a very small concentration of Ce^{4+} exists, which probably leads to the slight yellow or beige colour observed in the samples.

Keywords: glasses; crystallization; STEM; XANES; microstructure; optical properties.