Phase separation and crystallization in the system SiO_2–Al_2O_3–P_2O_5–B_2O_3–Na_2O glasses

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Abstract

The phase separation and crystallization behavior in the system $(80 - X)SiO_2 \cdot X(Al_2O_3 + P_2O_5) \cdot 5B_2O_3 \cdot 15Na_2O$ (mol%) glasses was investigated. Glasses with $X = 20$ and 30 phase separated into two phases, one of which is rich in Al_2O_3–P_2O_5–SiO_2 and forms a continuous phase. Glasses containing a larger amount of Al_2O_3–P_2O_5 ($X = 40$ and 50) readily crystallize and precipitates tridymite type $AlPO_4$ crystals. It is estimated that the phase separation occurs forming continuous Al_2O_3–P_2O_5–SiO_2 phase at first, and then tridymite type $AlPO_4$ crystals precipitate and grow in this phase. Highly transparent glass–ceramics comparable to glass can be successfully obtained by controlling heat treatment precisely. The crystal size and percent crystallinity of these transparent glass–ceramics are 20–30 nm and about 50%, respectively.

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