
Effect of Al₂O₃ on microstructure and chemical durability of phase-separating Na₂O-B₂O₃-SiO₂ glasses

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Abstract

Porous glasses are produced by thermally induced phase separation and chemical leaching of glasses with suitable compositions. Prominent examples for phase separation are sodium borosilicate (NBS) glasses, one of the best investigated phase separating glass systems. The introduction of Al₂O₃ into such (NBS) glasses allows a better control of the phase separation process (1) and the incorporated (AlO_x)-groups can act as acid centers in catalytic processes (2). By this, various applications are conceivable for such materials, *e.g.* as continuous flow micro reactors. Several investigations on the influence of heat treatment on phase separation are published, but only few with systematically added Al₂O₃.

To analyze the effect of Al₂O₃ on the properties of phase separated sodium borosilicate glass, a series of glasses with 66 SiO₂ : 26 B₂O₃ : 8 Na₂O + x Al₂O₃ with $x = 0$ to 6 mol % were synthesized and heat-treated for phase separation. Treatment times up to 120 h and temperatures between 630 and 760 °C were applied. The initial glasses before and after phase separation were characterized (XRF, XRD, pycnometry, dilatometry, DSC, ¹¹B/²⁷Al NMR) as well as leached with acids and alkaline solutions, subsequently. The obtained porous materials were analyzed by ICP-OES, electron microscopy and mercury intrusion porosimetry. Since in literature no information on chemical durability of such material is known, the leaching stability against boiling water and alkaline solutions were tested.

References:

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