Preparation and characterization of porous glass-ceramics in the Na2O-B2O3-TiO2 system

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Abstract

The preparation of porous glass-ceramics via a subtractive preparation principle is rarely reported, although it opens a pathway to innovative nanoporous ceramic materials. The concept of controlled crystallization is applied to induce crystallization in TiO2 glasses.
An interconnected crystal as well as glassy phase is obtained. Thereby the number of crystals, their growth rate and final size are controlled by a defined heat treatment. (1)
Within this study we prepared homogeneous glasses based on the ternary Na2O-B2O3-TiO2 system, which is firstly described in the studies of Strimple and Giess. (2) Structural and physical properties are investigated within the glassy area. Through different heat treatment and leaching conditions, TiO2 glass-ceramics with interconnected structures are produced. It was shown that variation of temperature and duration of heat treatment has an influence to the resulting domains and pore system. Therefore porous TiO2 glass-ceramics with a BET-surface area between 90 – 317 $m^2 \cdot g\text{-}1$, a cumulative pore volume *Vcum* up to 0.79 $cm^3 \cdot g\text{-}1$ and an adjustable pore diameter *dp* between 6 – 34 nm can be obtained.

These materials could be applied in the purification of contaminated water and air due to their photocatalytic properties or in hydrogen production by photoelectrochemical water splitting. (3, 4)

References

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