
Quartz inversion temperatures of LAS solid solutions of sol-gel derived glasses

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Abstract

It is well known that the inversion temperature T_c of quartz, that is the temperature of the reversible high-to-low quartz transformation, is for pure silica at 573 °C, and is for a synthetic solid solutions with less than 80 mol% SiO₂ and equimolar amounts of Al₂O₃ and Li₂O at temperatures below ambient. In contrast, the chemical dependence of the inversion temperature of compositions exceeding the impurity level of natural quartz is studied with less depth. To bridge the gap between natural quartz and fully stabilized synthetic high quartz solid solutions, Li_xAl_xSi(1-x)O₂ thin films (x in ca. 0.03 steps up to 0.18) were prepared by sol gel-dip coating of seeded silicon wafers. High temperature grazing incidence X-ray diffraction was used to study in situ the inversion process by measuring the diffracted beam intensity of the (102) and (111) reflexes in the 38-40 ° 2theta (CuKalpha) range. Inversion temperatures of the thin Li_xAl_xSi(1-x)O₂ films were found to decrease almost linearly with increasing LiAlO₂ content and can be approximated by the equation T_c (°C) = 573 – 2972x for x less than 0.18.

Keywords: quartz, inversion temperature, thin films, sol gel

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