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Elastic and inelastic properties of soda lime silicate glass melts

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Abstract
The influence of CaO on the elastic and inelastic behaviour of soda lime silicate glass melts of the series (26-x) $Na_2O \cdot x\ CaO \cdot 74\ SiO_2$ (composition in mol% with x = 0 to 16) is investigated. Longitudinal and transversal ultrasonic waves in the MHz frequency range are transmitted through the glass melt. Their velocities and damping behaviour are measured as functions of temperature. The elastic moduli, internal friction and relaxation times are calculated and their dependence on temperature and viscosity is shown. These properties describe the transition from an elastic to a viscoelastic and finally to a pure viscous behaviour of the investigated glass melts by a large dispersion range. Enhanced values of the moduli and activation energies are determined with an increase of CaO content. Thus, the structure of the melt becomes stronger and stiffer i.e. the mean bonding strength and the linkage of the dynamic network of the silicate melt is improved. The relaxation behaviour can be described by a Maxwell based model with a distribution function of relaxation times.