Dependence of the Strength of glass on Mobile Ions in the Glass Network

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Abstract:

In water or aqueous solutions only Region I crack growth is observed over most of the crack growth range. However, crack growth does depend on the glass composition as has been demonstrated by several authors. On a plot of the logarithm of the velocity, versus the applied stress intensity factor, some glasses (silica glass) plotted as straight lines, whereas others (soda lime silicate glass) exhibit a crack growth threshold. Gehrke *et al* clarified this behavior by showing that glasses containing mobile cations (Na^+, K^+, Li^+) exhibited thresholds, whereas glasses containing no mobile ions formed straight lines. In this talk we discuss this issue. Several important consequences of mobile cations in the silica network include crack wall corrosion, the build up of stresses around the crack tips, and the precipitation of silica at crack tips in silicate glasses. These issues will be discussed with regard to the strength of glass and the effect of these phenomena on glass strength.