# Statistical analysis of subcritical crack growth in water bearing soda-lime silicate glasses

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## Abstract

It is well known that subcritical crack growth (SCCG) in glasses is highly affected by the presence of water in the surrounding atmosphere of a propagating crack. Despite this, there is less knowledge on the influence of structurally bound water on crack propagation. For this purpose, soda-lime silicate glasses of up to 8 wt.% water were synthesized using an internally heated pressure vessel at 0.5 GPa. As the sample size is limited by this preparation route, standard test geometries, which allow to determine the stress intensity factor as a function of the crack length, such as double cantilever beam, are not feasible. Thus, radial cracks in hydrous glasses were initiated by Vickers indentation and the decelerating SCCG was captured by 60 seconds video sequences of high recording rate (30 frames per second). An automated image analysis algorithm was used for the precise and operator-independent analysis of the crack length of each video frame. Approximately 150 cracks per glass composition were analyzed to demonstrate statistical significance with respect to the broad scatter in Vickers-induced SCCG recently found for non-hydrated glasses. The results show that also for hydrated glasses the proper approach is to use averaged SCCG data of a large number of cracks to develop a precise analytic formulation of the effect of structurally dissolved water on SCCG.

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