

SLOW CRACK GROWTH STUDIES IN SILICATE GLASS  
USING DOUBLE TORSION TECHNIQUEK M S Premalal and B S B Karunaratne  
*Dept. of Physics, University of Peradeniya*

It is well known that brittle materials loaded to stress lower than the instantaneous fracture strength can fail some time after the application of the load. This phenomenon occurs as a result of slow growth of cracks, below the fracture stress. To avoid structural failures it is essential to have thorough understanding of the mechanism that controls the crack growth and also the extent of crack growth under the operating conditions. In this research programme, a relationship between stress intensity factor ( $K_1$ ) at the crack tip, and crack velocity ( $V$ ) was obtained for silicate glass. The stress intensity factor is the mechanical parameter that controls the crack extension in a stressed body.

The measurements were made using double torsion (D.T.) technique<sup>1,3</sup>. D.T. specimen is a rectangular plate with a groove at the middle along the length of the specimen. This groove ensures crack propagation in a direction parallel to the specimen length. Crack velocity was obtained by continuous monitoring of crack length optically, while the specimen was under stress. Low crack velocities ( $10^{-8}$  ms<sup>-1</sup>) were obtained by leaving the specimen for more than 24 hours under low stresses. The stress intensity factor  $K_1$  was calculated using a mathematical relationship<sup>1,3</sup> between  $K_1$ , the applied load, specimen geometry, and elastic constants.

This work shows that there is a unique relationship ( $V = AK_1^n$ ;  $A$  and  $n$  are

constants) between crack velocity  $V$  and stress intensity factor  $K_I$  as shown previously by other techniques.

### References

1. Lewis, M.H. and Karunaratne, B.S.B. (1981) Fracture mechanics methods for ceramics, rocks and concrete, ASIM SIP 745 13.
2. Widerhorn, S.M. (1978) Fracture mechanics of ceramics 4 549.
3. Williams, D.P. and Evans, A.G. (1973) Testing and Evaluation 1 264.