
The Fracture Toughness of Inorganic Glasses

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Abstract

Measuring the fracture toughness (K_{Ic}) of glasses still remains a difficult task, raising experimental and theoretical problems as well. The available methods to estimate K_{Ic} are reviewed. The critical flaw size, and the indentation load for the onset of crack initiation are discussed, in the light of the fundamentals of fracture mechanics and classical background regarding the mechanics of brittle materials. Analytical expressions were further proposed to predict the fracture energy and fracture toughness of glasses from different chemical systems from their nominal compositions. The theoretical values were compared with the experimental ones, as obtained by self-consistent methods such as the SEPB method. The remarkable agreement observed in most cases suggests that measured K_{Ic} values correspond to the crack propagation regime (as opposed to the crack initiation threshold), and supports previous investigations in glasses and ceramics, which showed that a crack tip is nearly atomically sharp in these materials (but for metallic glasses).

Keywords: glass, fracture toughness, SEPB, theoretical approach

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