

Stress Corrosion Cracking in electron irradiated SiO₂-B₂O₃-Na₂O glasses

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Oxide glasses find extensive uses in our world today due to their amorphous structure, optical transparency, electrical and heat insulation, and large hardness. However, oxide glasses have a major drawback: brittleness. Their failure properties are driven by the heterogeneities at small length scales, i.e. the nanoscale. Understanding how minute structural variations dictate the continuum level failure of materials is intrinsically important in assessing the life-time of materials. Herein, minute structural variations occur via “tweaking” the glass structure (i.e. varying the chemical composition of glasses and/or the structure via irradiation of glasses).

Studies herein concern 7 SiO₂-B₂O₃-Na₂O (SBN) Ternary glass systems. “Tweaking” the ratios of SiO₂-B₂O₃ and B₂O₃-Na₂O gives way to alterations in the structural and mechanical properties of the glasses and subsequently variations in the fracture process. To better understand how these chemical compositions relate structural variations to continuum level properties, the sample are irradiated with electrons. The suite of experiments exposes micro-scale structural variations to stress corrosion cracking fracture variations. Moreover, this research reveals how a good choice of the chemical composition plus electron irradiation can give way to improved stress corrosion crack behavior. The presentation will focus on stress corrosion fracture damage and how it varies with chemical composition and irradiation.