SiO2-B2O3-Na2O Glasses: Understanding how microscale changes alter macroscale fracture properties

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Abstract

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 mesoscale structure of the glasses. Linking these mesoscale variations to the overall macroscale properties provides new insight onto the controlling factors of glass failure. This is intrinsically important in assessing the life-time of materials. Herein, minute structural variations are controlled by selecting the chemical compositions of 7 SiO2-B2O3-Na2O ternary glass systems. These changes lead to mesoscale changes as revealed by a novel parameter coined the depolymerization index. This parameter reveals surprising trends with the stress corrosion cracking behavior in Region I. The presentation will focus on stress corrosion fracture damage and how it varies with chemical composition and the depolymerization index.

Keywords: SiO2, Na2O, B2O3 glasses, Stress corrosion cracking, fracture, Physical properties, structural properties

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