

## **A Photomechanics Study of Single and Cascading Crack Branch Formations in Soda-Lime Glass**

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Dynamic crack growth in high-stiffness and low-toughness amorphous materials such as soda-lime glass (SLG) often result in unprovoked crack branching events which are yet to be fully understood. The absence of optical tools for performing mechanical field measurements at sufficiently high spatio-temporal resolutions to decipher localized deformations at the tip of a crack growing at speeds in excess of mile-a-second has perpetuated this knowledge gap. The full-field method of Digital Gradient Sensing (DGS) has recently overcome some of these limitations when used in conjunction with ultrahigh-speed photography allowing quantification of fracture parameters associated with different phases of crack growth in SLG. In this work, time-resolved stress gradients are measured in SLG plates of two different geometries, first one producing a single crack bifurcation and the second cascading crack bifurcations, when subjected to dynamic wedge-loading. The measurements are then used along with the asymptotic crack tip fields to extract fracture parameters and identify crack branching precursors based on crack velocity, stress intensity factors, and higher order coefficients. The fracture surface roughness and its features are also separately quantified via high resolution post-mortem examination to corroborate with the optically measured quantities.