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(GOMD-GSP-P003-2018) Time and Humidity Dependence of Indentation Cracking in Aluminosilicate Glasses

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The inherent brittleness and poor crack resistance of oxide glasses have always been among their main limitations for advanced applications. As the formation of cracks leads to amplification of applied tensile stresses and ultimately catastrophic failure, there is an interest in understanding the composition and structure dependence of crack initiation and growth. The resistance to cracking can conventionally be measured using instrumented indentation that mimics the real-life damage for certain applications. Wada introduced a method to evaluate the crack resistance by counting the number of initiated cracks as a function of the applied load. Experiments have shown that the environmental humidity and the time period between indentation and crack counting affect the crack resistance value, but unfortunately these parameters are not always reported in literature studies. Here we study the time and humidity dependence of crack initiation in calcium aluminosilicate glasses. Depending on the experimental conditions (time and humidity), the crack resistance of an aluminosilicate glass can vary more than 100%. Furthermore, the observed radial/median cracks can initiate several hours after indentation. These results therefore indicate the need of a standardized procedure for determination of crack resistance to allow comparison of data from different research groups.