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Fracture of molecular glasses under tension and fracture-induced crystallization YINSHAN CHEN, TRAVIS POWELL, LIAN YU, University of Wisconsin-Madison — Molecular glasses are formed and fractured by cooling a liquid on a less thermally expansive substrate. In-plane tension is created by the mismatch of thermal expansion coefficients and accumulates to cause catastrophic network fracture. This simple experiment allowed the measurement of fracture toughness and the heat of fracture of molecular glasses for the first time. For the systems studied ($o-$terphenyl, indomethacin, and sucrose benzoate), the fracture condition is well described by recent theories and a material-specific energy release rate (fracture toughness) approximately 1 J/m^2. The heat of fracture was found to be anomalously high relative to the value expected for the energy release rate and the surface area created. The large release of heat is caused by the reduction of heat capacity for a glass film constrained on a rigid substrate. Rapid crystal growth was observed along fracture surfaces. (Ref.: Powell, C. T.; Chen, Y.; Yu, L. J. Non-Crystalline Solids 2015, 429, 122–128)

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