USING IMPACT-NANOINDENTATION TO TEST GLASSES AT HIGH STRAIN RATES AND ROOM TEMPERATURE

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In many daily applications glasses are indispensable, and novel applications demanding improved strength and crack resistance are appearing continuously. Up to now, the fundamental mechanical processes in glasses subjected to high strain rates at room temperature are largely unknown and thus guidelines for one of the major failure conditions of glass components are non-existent. Here, we elucidate this important regime for the first time using glasses ranging from a dense metallic glass to open fused silica by impact as well as quasi-static nano-indentation. We show that towards high strain rates, shear deformation becomes the dominant mechanism in all glasses accompanied by Non-Newtonian behavior evident in a drop of viscosity with increasing rate covering eight orders of magnitude. All glasses converge to the same limit stress determined by the theoretical hardness, thus giving the first experimental and quantitative evidence that Non-Newtonian shear flow occurs at the theoretical strength at room temperature.