Dependence on pressure of the glass transition temperature for a prototypical glass forming liquid

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One of the more important topics in condensed matter physics is the nature of glass-forming liquids and the glass transition, which has implications in everything from lubrication to polymer synthesis. While the glass transition has been studied extensively for many years under isobaric conditions, comparatively little work has been done on the transition as a function of pressure. I will examine the glass transition in the prototypic glass-former glycerol over the temperature range from 193 K, its atmospheric-pressure value, to 320 K, the glass transition temperature at 52.5 kbar. These very high pressures were obtained using a diamond anvil cell (DAC), and high-pressure ruby fluorescence spectra enabled us to determine the pressures and pressure gradients within the cell, which in turn allowed us to determine the glass transition temperature. I will compare our results to existing analytical data and previous experimental data acquired in our laboratory. While our data falls one to five percent below the analytical data, it matches the earlier experimental data very well. I will also examine what may be another method to experimentally find the transition point.

Information and data in the discussed thesis appear in the paper "New more accurate determination of the ruby fluorescence spectrum between 25 K and 600 K with applications to high-pressure research," A.V. Altom, C. Wells, M. Offenbacker, and W.F. Oliver, in preparation for J. Appl. Phys.