# Fragility and the Rate of Structural Ordering in Supercooled Metallic Liquids

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## Abstract:

"*Fragility* is a key concept often used to discuss glass formability; it is typically defined from the temperature dependence of the liquid viscosity. Our experimental measurements of the density of Cu-Zr liquids as a function of temperature show that the fragility is also reflected in the volume expansion coefficient of the liquid. A crossover behavior is inferred, with more fragile liquids having a larger thermal expansion coefficient near the glass transition temperature ($T_g$) but a smaller one at higher temperatures, suggesting a link between the rate of structural ordering and fragility. Experimental studies of the structure factor, $S(q)$ as a function of temperature in a range of alloy liquids support this. The magnitudes of the height of the first peaks in (1) $S(q)$, (2) the pair correlation, $g(r)$, and (3) the amount of icosahedral order, determined from Reverse Monte Carlo fits to the measured S(q), all show abrupt changes on approaching the glass transition temperature in fragile liquids. They change more continuously with decreasing temperature in strong liquids. The connection between the rates of structural ordering, as measured in X-ray scattering studies, and fragility is confirmed by measurements of the high-temperature viscosities of these metallic liquids. - Supported by the National Science Foundation (DMR-12-06707) and NASA (NNX10AU19G)."