

Thermodynamic correlations of kinetic fragility in glass forming liquids

Limin Wang

Yanshan University, Hebei, China

Email: l.ray.wang@gmail.com

Abstract:

Kinetic fragility of liquids has proven to be a crucial parameter in understanding glass transition physics and glass formation in materials. The construction of thermodynamic correlations of the kinetic parameter would be of significance in clarifying the physics of the concept. Based on the previously proposed correlation of fragility with heat of fusion of materials, a new thermodynamic correlation is explored focusing on the relaxation enthalpy involved in the enthalpy hysteresis around glass transition at an isochronal measurement. A quantitative correlation between kinetic fragility and relaxation enthalpy is shown, successfully applying to more diverse materials covering single and multi- component systems. An extension to zero relaxation enthalpy in the correlation points to the upper limit of fragility, consistent with an early result obtained from thermodynamic calculation. In addition, the fragility in mixtures is studied to correlate with mixing modes with an emphasis of the composition dependence of fragility in various miscible mixtures with diverse mixing heat. It is found that composition dependence of fragility invariably shows a negative deviation from the ideal mixing law, somewhat independent of mixing heat.