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Fragile-to-strong transition: a possibly universal feature of metallic glass-forming liquids

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Liquid fragility, which describes the degree of the non-Arrhenian viscous flow of glass-forming liquids at the glass transition temperature (T_g), is one of the most intriguing topics in modern glass physics. In particular, the fragility of metallic glass-forming liquids (MGFLs) remains a fascinating puzzle, as no existing viscosity model is capable of describing the dynamics over the full range of temperatures. In this presentation, we attempt to clarify this puzzle by separately examining the dynamic behaviour of both the equilibrium liquid at high temperature and the metastable supercooled liquid near T_g . Remarkably, we find that a fragile-to-strong (F-S) transition occurs in all of the MGFLs under study. This suggests that the F-S transition is not limited to a few liquids like water and silica, but is apparently a universal behaviour of MGFLs. The degree of the F-S transition is determined for each of the studied MGFLs. In addition, we propose a model for the F-S transition that accurately captures the scaling of dynamics across both the fragile and strong regimes and provides physical insights into the origin of the fragile-to-strong transition.