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Accessing supercooled liquid dynamics of extremely poor glass formers by a containerless levitation viscometer

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Assessing the supercooled liquid dynamics (SCLD) of extremely poor glass formers is critical for understanding the nature of glass formation and glass transition. So far, the SCLD of such glass formers is poorly understood. This is because the SCLD of poor glass formers is not assessable using conventional techniques as their crystallization kinetics is far beyond the time window of viscosity measurements. However, some promising development has recently been achieved in assessing the SCLD of poor glass formers using a levitation viscometer. The viscometer is capable of not only determining viscosity at high temperature, but also of drastically broadening the supercooled region. This allows us to investigate the SCLD of refractory oxide. Here, we report our recent findings about the dynamical behavior of calcium aluminate. The viscosity is measured in a broad supercooled range (up to 450 K) by the levitator. The results show the fragile-to-strong transition in the supercooled region. The structural and thermodynamic origin of such transition is explored by performing calorimetry, Raman spectroscopy, NMR and XRD experiments on the melt-quenched glasses. The compositional dependences of T_g, fragility, glass forming ability and configurational heat capacity are found to be rather different from literature, and the source of such difference is discussed.