

Abstract Submitted
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Onset of cooperative dynamics in equilibrium glass-forming metallic liquids ABHISHEK JAISWAL, YANG ZHANG, Univ of Illinois - Urbana — Onset of cooperative dynamics has been observed in the metastable regime of many molecular liquids, colloids, and granular materials approaching their respective glass or jamming transition points. It is also considered to play a significant role in the emergence of slow dynamics. However, the nature of such dynamical cooperativity remains elusive in multicomponent metallic liquids characterized by complex many-body interactions and high mixing entropy. Herein, we report indications of the onset of cooperative dynamics in an equilibrium glass-forming metallic liquid (ZrCuNiAl). This is revealed by deviation of the experimentally measured mean diffusion coefficient from its high temperature Arrhenius behavior below $T_o \approx 1300$ K, i.e., a crossover from uncorrelated dynamics above T_o to landscape-influenced correlated dynamics below T_o . The onset/crossover in this system is observed at approximately twice of its calorimetric glass transition temperature ($T_g \approx 697$ K) and in the stable liquid phase, unlike many molecular liquids. Furthermore, we show the presence of such a dynamical onset phenomenon in ten other glass-forming metallic liquids, universally occurring at approximately twice of their T_g and in their liquid phases.

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