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Visualizing Strain Driven Glassy Behaviors in Manganite Film

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The glassy state in phase-separated manganites, which is produced by multiple phases with different electronic and magnetic properties, has attracted intensive attention [1,2]. Ability to manipulate and microscopically observe the dynamics of glassy phase are crucial for comprehensive understanding of glassy behavior and also for designing their device functions. In this presentation, we will show the glassy behavior in $Pr_{0.55}(Ca_{0.75}Sr_{0.25})_{0.45}MnO_3$ (PCSMO) thin film, which does not exist in bulk material, by using epitaxial strain. The dynamics of each phase in this artificial glassy system have been revealed by transport measurements and also by a novel microwave impedance microscopy. Comparable vigorous dynamics have been found around 50 K and freezes below 20 K as a result of competition between epitaxial strain, thermal energy, and other ordered degrees in PCSMO film. Our data suggest that the degree of lattice deformation is important in the kinetics of complex oxides and provides a guideline for the production of emergent phenomena, such as phase-separation and glassy behavior, which might be much useful in further applications.

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