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Laboratory studies on the rheology of cryogenic slurries with implications for icy satellites ELIZABETH CAREY, KARL MITCHELL, MATHIEU CHOUKROUN, FANG ZHONG, Jet Propulsion Lab — Interpretation of Cassini RADAR and VIMS data has suggested some landforms on Titan may be due to effusive cryovolcanic processes that created cones, craters and flows [1]. High-resolution Voyager 2 images of Triton also show strong evidence of cryovolcanic features [2]. Fundamental to modeling of cryovolcanic features is the understanding of the rheological properties of cryogenic icy slurries in a thermodynamic and fluid mechanical context, i.e., how they deform and flow or stall under an applied stress. A series of measurements were performed on methanol-water mixtures and ammonia-water mixtures. We measured the rheology of the slurries as a function of temperature and strain rate, which revealed development of yield stress-like behaviors, shear-rate dependence, and thixotropic behavior, even at relatively low crystal fractions. Visualization of icy slurries supports the current hypothesis that crystallization dominates rheological properties. We shall discuss these findings and their implications for cryovolcanism on icy satellites.

[1] Lopes, R. M. C., et al., 2013. Cryovolcanism on Titan: New results from Cassini RADAR and VIMS. J. Geo. Res. 118, 416-435.
[2] Smith, B. A., et al., 1989. Voyager 2 at Neptune: Imaging science results. Science 246, 1422-1450.

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