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Mechanical properties of dust and ice mixtures expected in the Martian polar caps and permafrost.

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In order to discuss flow behavior of Martian polar caps and permafrost mechanical properties of water ice–particle mixtures need to be well understood. So far some experimental studies on the rheology of ice-particle mixtures have been carried out under rather high stress regime ($10^0 \sim 10^1$ MPa) but not in low stress regime below 10^0 MPa, which becomes important in discussing the Martian ice dynamics. In this study we investigated the rheology of ice-particle mixture in a low stress regime between 10^{-1} and 10^0 MPa.

We conducted deformation tests using artificial ice samples that have various concentrations (0. 5, 20, 40wt%) of silica particles with a uniform size of 0.3?m. Samples were prepared by a similar method described by Durham et al. The creep tests with a constant stress were made for low stress regime below 1 MPa and the extrusion tests with a constant strain rate were made for high strain rate regime above $10^{-7}s^{-1}$. Temperature during deformation was kept at a constant (268, 265, 253K) within $\pm$0.5K. Micro crystal textures before and after each test were examined under a microscope.

Strain rate vs. stress relationships obtained from present work show that the stress exponent for ice with high concentration of silica (20% and 40%) becomes much larger than three that is for the pure water ice. This suggests that ice with high silica content becomes extremely stiff in low stress regime like Martian polar caps. Now we are carring out creep tests under much lower stress ($<10^{-1}$ MPa) regime.