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The Role of fluid-filled Grain Boundaries in Substructure Development: New Insights from see-through Deformation Experiments.

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We study the role of complex, fluid-filled grain boundaries in substructure development, using real-time observation in a transmitted light deformation apparatus with controlled fluid pressure and a miniature internal load cell, and PIV measurement of the displacement field. Sample materials are rock salt (NaCl) and Camphor ($C_{10}H_{16}O$) polycrystals, with a range of different fluids. Measurement of crystal orientations during the experiment is in development.

Results show a range of possible interactions of fluids with grain and subgrain boundaries, deformation of fluid inclusions and large changes in grain boundary velocity during deformation and show many similarities with high temperature, fluid-rich tectonites.

Systematic measurements of grain boundary migration rates, evolution of crystal orientations and displacement fields in a series of experiments, in combination with observations of the morphology of the grain boundary fluid provide an observational base of mobile, fluid-filled grain boundaries for the numerical model ELLE.