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Shear strain localization in torsion experiments

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We used torsion experiments to investigate how mineral composition, grain size and distribution, temperature, scale and fluid content can trigger shear strain localization. The tested synthetic aggregates were composed of one, two or three mineral phases, with a matrix of halite comprising 100% of the sample in the one-phase specimen, 80% of the sample in the two-phase specimens, and 50% in the three-phase sample. Halite was mixed with muscovite (fine or coarse), or calcite, or calcite plus fine muscovite. The experimental results show that: (1) strain did not localize in pure halite at temperatures from 100 to 300º C; (2) strain did not localize, at sample scale, when the specimen was polymineralic and temperature $\leq$ 200º C (therefore, the condition of polyphase aggregate is not sufficient, but it is necessary because temperature by itself did not trigger localization in a 100% halite specimen; temperature is also not sufficient, although it is necessary when together with polyphase); (3) temperature triggered localization (shear zones parallel to shear plane) at 300º C when the sample was composed of two phases with contrasting rheology, but depended on mineral composition (muscovite or calcite), grain size (coarse or fine muscovite), and mineral distribution in the specimen with fine muscovite; (4) fluids can help localization, but also depends on mineral composition and grain size; (5) localization depends on scale, i.e. heterogeneous deformation apparent at one scale seems homogeneous at a larger scale.