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Time dependent cataclastic deformation of very soluble elastic/brittle salts

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Two types of experiments were carried out at room temperature on very soluble elastic/brittle salts used in our laboratory as a rock analogue material for in-situ microscopy study of dissolution/precipitation deformation processes ("pressure" solution, cataclastic solution creep):

1) The effect of elastic strain on the microstructure (micro topography) of free surfaces of K-alum ($KAl(SO_4)_2 \cdot 12H_2O$) and $NaClO_3$-single crystals (typically 4 x 4 x 12 mm in size) was studied while the crystals dissolved in an undersaturated solution. Regular arrays of dissolution etch grooves (typically 20 µm deep, 40 µm wide) developed in an orientation approximately perpendicular to the maximum compressive stress, and following crystallographic low index directions. Because of localisation of the stress, grooves can develop into a fracture network and time-dependent cataclastic deformation of the rim of the stressed crystals.

2) Wet $NaClO_3$ synthetic polycrystals (grain size XXX µm) were stressed and microscopically studied "in-situ". Irregularly distributed etch grooves developed on grain boundaries under relatively low surface normal stress, i.e. parallel to the maximum compressive stress. These etch grooves also developed into fractures leading to time-dependent cataclastic deformation of the grains. On removing the stress the fractures healed and grooves dissappeared.

Similar observations have been made in deformation experiments on quartz.