1 atm high temperature creep tests on fine-grained anorthite aggregates

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We conducted one-atmosphere uniaxial and tri-axial compression experiments on synthetic fine-grained (~1 μm) anorthite aggregates ($CaAl_2Si_2O_8$) with different Al/Si ratios (Al/Si = 1 and Al/Si = 0.97) and with/without doping 1 wt% MgO. The samples are estimated to have deformed by interface (reaction)-controlled and grain-boundary diffusion creep mechanisms. Strain rates at similar stress, temperature and grain sizes varied by ~4 orders of magnitude among the samples. The reduction of Al/Si ratio weakens the aggregate by ~2 orders of magnitude. Further weakening occurs by MgO-doping, which is large enough to mask the Al/Si effect. The consequent low viscosity is comparable to that during grain-boundary creep of anorthite in previous studies. Grain boundary sliding (GBS)-induced rigid-body like grain rotation was identified by the observation of the marker-etched sample surface after the deformation. GBS occurs preferentially along grain-boundaries parallel to (010) and further, in the direction of [100] within the grain-boundary plane, which results in grain rotation to develop crystallographic preferred orientation with <100>{010} fabric and shape preferred orientation during diffusion creep.

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