Geophysical Research Abstracts
Vol. 21, EGU2019-16239, 2019
EGU General Assembly 2019

Numerical Experiments on Boundary Localisation of Shear Strain in Two-Phase Aggregates

Giulia Fedrizzi, Manuele Faccenda, and Giorgio Pennacchioni
University of Padova, Dipartimento di Geoscienze, Padova, Italy (fedrizzigiulia@gmail.com)

Ductile shearing is commonly localised to precursor tabular heterogeneities. In natural rocks, ductile shearing is either homogeneously distributed within relatively weak layers or localised at the boundary between a strong layer within a weaker material. Boundary strain localisation is observed in nature from the micro-scale to the scale of major tectonic lines, but there is not yet a robust explanation for this process.

We performed 3-D, high-resolution numerical simulations of a layer of two-phase aggregate deformed by simple shear that could provide a model for the occurrence of boundary strain reactivation in some cases. The modelled layer consists of initially spherical inclusions, randomly dispersed in a matrix of different rheology. Deformation is induced by two sliding rigid plates at the top and bottom of the layer. Deformation experiments were conducted for (i) both Newtonian and non-Newtonian (power-law) rheology, (ii) various viscosity contrasts, (iii) different domain sizes and (iv) variable inclusion concentrations. Shear strains of as much as 10 were achieved.

In the case of weak inclusions in a stronger matrix, the more deformable portion is initially at the core of the layer. After a threshold shear strain is reached (ca. 3.5), boundary localisation starts to occur and becomes more pronounced with increasing shear strain.
In aggregates with strong inclusions within a weaker matrix, strain localisation at the boundaries appears from the very first stages of the numerical experiment and is much stronger than at equivalent shear strains in the model with weak inclusions. The boundary reactivation is particularly effective for non-Newtonian rheology, especially at intermediate bulk strains.