Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SCG07-04 Room:106 Time:May 21 10:00-10:15

Intracrystalline plastic deformation of chromite: a case study on dislocation creep mechanisms

Biswajit Ghosh[1*], Santanu Misra[2], Tomoaki Morishita[3], Karsten Kunze[2]

[1]University of Calcutta, [2]ETH, [3]Kanazawa University

Detailed microstructural observations on natural chromite samples from the Sittampundi Layered Anorthosite Complex (SLAC), southern India reveal intracrystalline plastic deformation. The SLAC was formed in Neoarchaean and was subjected to eclogite facies metamorphism (>1000 C and >20 kbar), later exhumed in the latest Neoproterozoic-Cambrian. Before this study diffusion creep has typically been considered as the principal deformation mechanism in chromites. We describe three dislocation creep regimes in this mineral that produced distinctive microstructures with increasing temperature. The plastic deformation commences with grain boundary bulging recrystallization in regime 1. At relatively higher temperatures diffusion controlled strain accommodating mechanisms take over. Regime 2 is characterized by formation of new high angle grain boundaries and it corresponds to subgrain rotation recrystallization followed by nucleation of dislocation-free new grains in regions of high strain. At more elevated temperature the dominant accommodating mechanism switches over to recrystallization accommodated dislocation creep in regime 3 from the recovery accommodated one in the earlier regime. This corresponds to grain boundary migration recrystallization. The movement of high angle grain boundaries through strained grains in this creep regime provides high diffusivity paths for the rapid exchange of components which may produce compositional heterogeneity in the recrystallized grains.

Keywords: Spinel, Plastic deformation, dislocation creep