Geophysical Research Abstracts
Vol. 14, EGU2012-5313-3, 2012
EGU General Assembly 2012

Cr diffusion in $MgAl_2O_4$ synthetic spinels: preliminary results

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Chromian spinel is an accessory phase common in crustal and mantle rocks, including peridotites, gabbros and basalts. Spinel, it has been identified as one of the most effective, sensible, and versatile petrogenetic indicator in mafic and ultramafic rock systems due to the strict interdependence between its physico-chemical properties (chemical composition, cation configuration etc.) and genetic conditions (temperature, pressure, and chemical characteristics of the system). In particular, studies on intra- and inter-crystalline Mg-Fe^{2+}, Cr-Al exchange demonstrated the close relationship between spinel composition and both degree of partial melting and equilibrium temperature of spinel-peridotites. Moreover, studies focused on the chemical zoning of Mg-Fe^{2+} and/or Cr-Al components in spinel have been used, combined with a diffusion model, to provide quantitative information on peridotites and gabbros pressure-temperature paths and on deformation mechanisms. Although these potentials, most of the experimental studies have been performed on spinels hosting a limited content of divalent iron (sensu stricto, $MgAl_2O_4$), whereas the scarce studies on Cr-Al inter-diffusion coefficient have been performed at 3-7 GPa as pressure boundary condition.

In order to contribute to the understanding of processes occurring in the lithospheric mantle, we have initiated an experimental research project aiming at determining the Cr-Al inter-diffusion in spinel at 2 GPa pressure and temperature ranging from 1100 to 1250 °C. The experiments were performed in a end-loaded piston cylinder by using a 19 mm assembly and graphite-Pt double capsules. As starting materials we used synthetic Mg-Al spinel (200-300 μm in size) and Cr_2O_3 powder. Microanalyses of experimental charge were performed on polished carbon-coated mounts by electronic microprobe. Line elemental analyses were made perpendicular to the contact surface between Cr_2O_3 powder and spinel, at interval of 2 μm. By processing these preliminary data, we have estimated a diffusion coefficient of chromium (D) of $7.6 \cdot 10^{-15}$ $m^2 s^{-1}$.