

Preliminary experimental investigation of chromite dissolution in mid-ocean ridge basalt melt

N. ZAGRTDENOVA¹, A. Y. BORISOVA¹, M. TOPLIS²,
B. DUPLOYER³ AND C. TENAILLEAU³

¹GET/CNRS, 14 Avenue Edouard Belin, University of Toulouse, France (nail.zagrtdenov@get.obs-mip.fr)

²IRAP/CNRS, 14, Avenue Edouard Belin, Toulouse, France

³CIRIMAT/CNRS-UPS, University of Toulouse, France.

Chromite is a common accessory mineral in upper mantle rocks (*e.g.* dunites, harzburgites). Interaction with MORB like melts may dissolve this mineral providing a window into the kinetics of upper mantle assimilation by magmas.

Spheres of natural chromite without inclusions (from the Silesia ophiolite in Poland) were prepared using a Bond mill. The subsequent diameter (~ 300 - 500 microns) was measured using the scanning electron microscope (SEM). Each sphere was introduced into a droplet of MORB melt suspended on a Pt-wire loop (typically 2-3 mm). This assemblage was held in a vertical furnace at 1 bar pressure and an oxygen fugacity corresponding to the FMQ buffer. Initial experiments were performed at 1450°C , sufficiently high that all the chromite should dissolve in the liquid (as predicted by thermodynamic calculations using MELTS). Experiments were of variable duration and were terminated by rapid quench into air. The MORB glass with partially dissolved chromite was analyzed by X-ray tomography (for inner and outer shapes, and average radius determination) and by FEG-EMPA (to obtain the concentration profile around the sphere).

An example of initial and final shape is illustrated in Figure 1 for a 4 hour experiment. The calculated linear dissolution rate is $2.2 \cdot 10^{-9}$ m/s at 1450°C . This size change and the corresponding profile in Cr_2O_3 around the chromite sphere (~ 40 μm in length) is consistent with diffusion-limited dissolution and a diffusion coefficient of chromium in the MORB liquid of $\sim 1 \cdot 10^{-13}$ m^2/s .

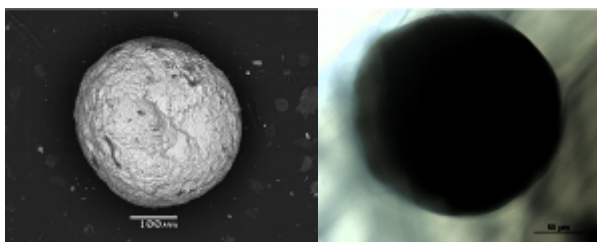


Figure 1: The chromite sphere before (left side, SEM data radius 177 μm) and after (right side, optical microscope photo, radius 146 μm) dissolution in MORB melt.