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Si-in-spinel geobarometry for ultramafics

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Spinel (Sp) is a common minor constituent of ultramafic rocks from a wide variety of geodynamic settings. Chemical analyses of Sp almost always show presence of small but significant amount of SiO_2. In the olivine (Ol)-bearing rocks the SiO_2 content of Sp is controlled by the following net-transfer reactions:

Mg_2SiO_4 (Fo) = $Mg[Mg,Si]_2O_4$ (Ring in Sp) (1);

Fe_2SiO_4 (Fa) = $Fe[Fe,Si]_2O_4$ (Fe-Ring in Sp) (2).

In the end-member silicate systems Ol-Sp (Ring or Fe-Ring) transformation takes place at very high pressure, and is almost independent of temperature, what makes reactions (1) and (2) nearly perfect geobarometers. Because of the very dilute compositional range of silica in the naturally occurring Sp, reactions (1) and (2) need to be experimentally calibrated at the pressure values well below the silicate end-member transition. We have obtained first experimental data on the equilibrium silica content in aluminous Sp according to reactions (1) and (2) at T=1000^{o}C in the pressure range P from 1-5 GPa, and at 1100^{o}C, 2 GPa. The experiments were made in conventional piston-cylinder apparatus (up to 3 GPa) and modified Bridgman anvil (at 5 GPa). Crystalline mixes of pre-synthesized Ol and Sp were used as starting materials. Run products were analyzed with electron microprobe in the wave-length dispersive mode. Our results demonstrate that at 1000^{o}C the equilibrium SiO_2 content in Sp increases from 0.20 to 0.70 wt.% in the Fe-system and from 0.06 to 0.46 wt.% in the Mg-system with P increasing from 1 to 5 GPa. A 100^{o}C increase in T at 2 GPa resulted in only very minor decrease in the amount of dissolved SiO_2 in both Fe- and Mg-systems, consistent with a very shallow positive dP/dT slope of the end-member reactions (1) and (2). Direct application of the experimental results to Ol and Sp-bearing inclusions in diamonds gives P estimates not always consistent with the diamond-graphite equi-

librium curve, which indicates that a correction for Cr content in Sp may be necessary to apply the geobarometer for the Cr-rich Sp. This work was supported by the RFBR grants # 06-05-64976 and 06-05-65059.