Growth of Forsterite and Enstatite Double Layer from Quartz and Periclase Reaction

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The double layer growth of forsterite + enstatite from the reaction of periclase + quartz was investigated. Samples were prepared by either putting large faces of single crystals into contact, quartz in the middle and periclase and forsterite on both sides or by embedding fragments of periclase and forsterite in a matrix of fine quartz grains. Forsterite was added to react with quartz and to produce enstatite layer and thus to allow for comparison and calibration with previous studies of single layers (e.g. Fisler et al., 1997; Milke et al., 2001; Milke et al., 2007). Experiments were performed in piston-cylinder apparatus for temperatures ranging from 1200 to 800 °C during 24 h at 10 kb, with Al_2O_3or CaF_2as solidpressure media.

he apparent parabolic growth rate of enstatite at the quartz-forsterite interface for the experiment with single crystals and Al_2O_3 pressure medium setting at 1200°C is in agreement with the latest "dry" experiments (Milke et al., 2007). The double layer at the quartz-periclase interface is made of 1.1 and 0.80 μm thick forsterite and enstatite layers respectively. The enstatite layer thickness is similar in both the double and the single layers, thus suggesting forsterite did not grow on the expense of enstatite in the double layer.

Growth is enhanced when pressure medium is replaced by CaF_2. The enstatite single layer becomes 5.4 μm thick. In the double layer, the mean forsterite and enstatite thicknesses are respectively 12 and 2.7 μm. Moreover, forsterite growth occurred on the expense of the enstatite layer.

In the same conditions, i.e. at 1200°C with CaF_2 as pressure medium, results are similar for samples where periclase and forsterite fragments were embedded in a quartz matrix. However the double layers can be similar or even thicker at 1000°C and 800°C.

Theses different behaviours among experiments are interpreted as a strong influence of the various small amount of water brought to the system from the pressure media or initially adsorbed on powder grain surfaces.

References

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Abs. No. **254**
Meeting: **DMG 2008**
submitted by: **Gardes, Emmanuel**
email: **gardes@gfz-potsdam.de**
date: **0000-00-00**
Req. presentation: **Vortrag**
Req. session: **S09**