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Wetting properties of partially molten peridotite up to 10GPa

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Many physical properties such as permeability, elastic properties, electrical conductivity and rheology of liquid-bearing rocks in the deep Earth& #39;s interior are strongly controlled by its wetting behavior. We report experimental results on the variation of dihedral angle and microstructures in the partially molten peridotite system at temperatures ranging from 1473K to 2073K and pressures up to 10 GPa. A piston cylinder apparatus was used for experiments up to 3 GPa and the Kawai type multi-anvil apparatus (1000 ton) for experiments above 4 GPa. The starting material is powder of a spinel lherzolite (KLB1). The starting materials were placed in a graphite capsule. The dihedral angle were measured on the polished section using a field emission scanning electron microscope. Because the run products above 4 GPa shows the singnificant seggregation of silicate melt toward the heat spot, the dihedral angle could not be measured. At the constant pressure, the dihedral angle of olivine-silicate melt-olivine decreases with increasing temperature. The dihedral angle of the system above the top of the oceanic asthenosphere is approximately 0 degrees, corresponding to completely wetted grain boundaries. This condition is probably reached because of a decrease in the solid-liquid interfacial energy with temperature and pressure due to the dramatically increased Mg/Si of silicate melts. These results suggest that the presence of partial melt would have drastic influences on physical properties of upper mantle beneath the 100km depth, even if the melt fraction is very low. Low velocity regions at the top of the oceanic asthenosphere may result from very small amount of hydrous melt.