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CHEMICAL INTERACTION OF Mg-CARBONATE AND THE EARTH'S LOWER MANTLE MINERALS

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Diamonds of lower mantle origin are rare but important guests at Earth surface currying crucial information about deep interiors. Apart minerals expected to be similar in Earth lower mantle (particularly Mg-Fe-Al silicates and MgO-FeO oxides) ultra-deep diamonds contain primary inclusions of carbonates indicating that they are presented in the Earth lower mantle. Carbonates of magnesium, calcium, iron and sodium are stable at wide pressure-temperature conditions close to the geotherm. We studied interaction of Mg-carbonates with ferropericlase, perovskite employing laser-heated diamond anvil cell (DAC) at pressures up to 60 GPa and temperatures over 3000 K.

Melting of Mg-carbonate is determined as congruent under PT-conditions of the lower mantle. The $MgCO_3$ melts are stable in an expanded high-pressure high-temperature field. We observed formation of diamond at 18 and 40 GPa as a result of decomposition of $MgCO_3$ melt at temperatures above 3500 K on the high-temperature boundary of the field. Melting reactions of the $MgCO_3$-(Mg,Fe)O system were studied in the 30-63 GPa range at high temperatures up to 3600 K. It was found that decomposition boundary of $MgCO_3$-(Mg,Fe)O melt is close to the pure $MgCO_3$ decomposition one within $\pm$ 150 K (accuracy of DAC experiment). Preliminary data shows that perovskite -(Mg,Fe)(Si,Al)O_3reacts with $MgCO_3$ at PT-conditions of 24GPa/2000K and 60GPa/2500K, that is close to the boundary of congruent $MgCO_3$ melting. The reaction is accompanied with formation of diamond and MgO.

The experimental data on melting phase relations $MgCO_3$, $MgCO_3$ - (Mg,Fe)O and $MgCO_3$-(Mg,Fe)(Si,Al)O_3 systems combined with diamond crystallization are applied to the problem of ultra-deep diamond formation in carbonate-bearing parental media of the Earth's lower mantle.

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