European Mineralogical Conference
Vol. 1, EMC2012-360, 2012
European Mineralogical Conference 2012

Stability of Ca-carbonate melt and reactions with the Earth's lower mantle minerals

A. Spivak (1), Yu. Litvin (1), and L. Dubrovinsky (2)

(1) Institute of Experimental Mineralogy RAS, Laboratory of Fluid-Magmatic Interactions, Chernogolovka, Russian Federation (spivak@iem.ac.ru), (2) Bayerishes Geoinstitut, University Bayreuth, Germany

Melting of Ca-carbonate, $CaCO_3$ - (Mg,Fe)O and $CaCO_3$ - (Mg,Fe)(Si,Al)O_3 systems, stability of the melts and their decomposition were studied in static high pressure experiments at pressures from 16 to 79 GPa and temperatures of 1600 - 3900 K using diamond anvil cell technique with laser heating. It was determined that melting of Ca-carbonate is congruent at the PT-conditions of the lower mantle and characterized by an expanded field of liquid Ca-carbonate phase. We observed formation of graphite (below 16 GPa) and diamond (between 16 and 43 GPa) on decomposition of the $CaCO_3$ melt at temperatures above 3400 K. At temperatures below 3400 K congruent melting of calcium carbonate was confirmed. It is shown that the $CaCO_3$ - (Mg,Fe)O system melts congruently to 3400 K at 16 GPa and to 3600 at 43 GPa. The presence of (Mg,Fe)O component does not affect to position of high-temperature decomposition boundary of $CaCO_3$ component of the system. The decomposition boundary was marked by formation of 13C-diamond. It was also shown that $CaCO_3$ - (Mg,Fe)O - C system is capable to form diamonds together with Ca-carbonate and magnesiowustite as syngenesis minerals at PT-conditions of the lower mantle. It was found that diamond (between 40 and 79 GPa) on decomposition of the $CaCO_3$ component from $CaCO_3$ - (Mg,Fe)(Si,Al)O_3 melt at temperatures above 2000 K formed. We observed formation of Grt and Cpx on chemical interaction in the $CaCO_3$-(Mg,Fe)(Si,Al)O_3 at 18 GPa and 1900 K in experiment with the use of multianvil apparatus. By general composition, the boundary compositions of the high-pressure oxide-silicate-carbonate-diamond system under study are close to the natural LM parental media for super-deep diamonds. In connection with this, the melting diagrams are applicable to physico-chemical conditions of syngenetic formation of diamond and heterogeneous phases trapped by diamonds as primary inclusions and important to disclose basic features of natural genesis of super-deep diamonds.

This work was funded by grants of President of RF MK-913.2011.5, FPP 2011-1.3.1-151-006_6 and RFBR 10-05-00654, 11-05-00401.