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Melting Relations of Multicomponent Carbonate System $MgCO_3$ – $FeCO_3$– $CaCO_3$– Na_2CO_3 at 12-23 GPa

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Considerable attention is focused on high-pressure high-temperature experimental study of

melting phase relations of carbonates which were involved into a 'super-deep' diamond genesis.

High-pressure stability of carbonate melts and their role in 'ultra-deep' diamonds genesis are

most essential.

Experimental study of melting relations of multicomponent carbonate system was carried out using multi-anvil press at the pressures 12 - 23 GPa and temperatures 800 to 1650 ^{o}C. Chemical compositions of starting carbonate system used for melting experiment were prepared by mixing: $FeCO_3$ – 26,00; $MgCO_3$– 26,00; $CaCO_3$ – 25,00; Na_2CO_3 – 23,00 wt %.

A region of partial melting for the system is experimentally determined. The partial melting field is arranged between low-temperature boundary of eutectics melting (solidus line) of the multicomponent carbonate and the boundary of complete melting (liquidus line) at higher temperature. From experimental observations, a Mg-Fe carbonate solid solution is the liquidus phase. At temperature lowering, the assemblage $(Mg,Fe)CO_3$ + $(Ca,Na_2,Fe)CO_3$ + L (liquid) is formed. Then, the invariant eutectic assemblage $(Mg,Fe)CO_3$ + $(Ca,Na_2,Fe)CO_3$ + $Na_2(Ca,Fe)(CO_3)_2$+ L (liquid) which is determining for subsolidus assemblage $(Mg,Fe)CO_3$ + $(Ca,Na_2,Fe)CO_3$ + $Na_2(Ca,Fe)(CO_3)_2$ is formed. Next to liquidus line is one-phase field of completely miscible multicomponent carbonate melt. On the whole, the results demonstrate phase relations of solid carbonates and multicomponent carbonate liquid in the immediate vicinity to the low-temperature melting boundary. The early melting of the multicomponent carbonate system is compatible with the lower mantle geothermal conditions because the primary melting temperatures are noticeably below than the geothermal values. It is significant that multicomponent carbonate melts are stable and completely miscible under conditions as partial so complete melting. Thus, high-pressure high-temperature experimental data demonstrate that multicomponent carbonate melts are stable under the transition zone and lower mantle conditions.

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