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合成カンラン岩の漸次的温度変化時の電気伝導度連続測定：部分融解の影響
Continuous measurements of electrical conductivity of synthetic peridotite under changing temperature: Melting effect

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Transport properties of the mantle (ex. electrical conductivity, viscosity, and seismic attenuation) sharply changes during ascend of the mantle especially at around mantle solidus. Electrical conductivity is considered to be the most sensitive property to the presence of partial melt. To understand how partial melting changes the conductivity of ascending mantle (ex. mid-ocean ridge), we measured the electrical conductivity of synthesized peridotite samples, which have different manners of melting with temperature, during slow increases and decreases in temperature under atmospheric pressure.

Three types of samples, forsterite (80%) + diopside (20%), forsterite (95%) + diopside (5%) and forsterite (50%) + enstatite (40%) + diopside (10%) with addition of 0.5% spinel, were synthesized from $Mg(OH)_2$, SiO_2, $CaCO_3$ and $MgAl_2O_4$ powders with particle size of <50 nm. We continuously measured the electrical conductivity of these samples at temperature range from 1100 ℃ to 1400 ℃. Microstructures of the samples quenched from above solidus were observed by scanning electron microscopy (SEM) in order to measure the melt fraction.

The electrical conductivity at well below (>50 ℃) solidus of the forsterite + diopside samples exhibited a linear distribution in their Arrhenius plots indicating that a single mechanism controls. Such linear relationship was no longer observed at higher temperature regime exhibiting its exponential increase until the temperature reached to produce a phase assembly of forsterite + melt. In addition, the grain size dependence on electrical conductivity disappeared at temperature between 1350 ℃ and 1360 ℃, indicating that the effective conductive path changed from grain boundary to other path. The result indicates that there is a phase assembly of forsterite + diopside + melt phase at around 1360 ℃ which has not been appeared in the previously reported phase diagram (Kushiro and Schairer, 1963).

Monotonic increase of electrical conductivity was observed above solidus of the forsterite + enstatite + diopside + spinel sample, and such increment is considered to be strongly related melt fraction changing with temperature, which is supported from SEM observation.

キーワード: 電気伝導度, カンラン岩, 部分融解, メルト分率
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