V033-P004 Time: May 29 17:00-18:30

Physical properties of melt in the system diopside-potash feldspar ; an analogus melt system of natural magmas

Satoshi Kanasugi[1], Hiromitsu Taniguchi[2], Akio Goto[3]

[1] Inst. Min. Petro. Econ. Geol., Tohoku Univ., [2] CNEAS, Tohoku Univ, [3] CNEAS

It is important to understand the change of physical properties and its physicochemical background of magmas with mixing of two contrastive magmas such as basalt and a rhyolite. The natural magma system, however, is difficult to treat theoretically due to their chemical complex nature. Based on the composition and melt structure, diopside (Di) - potash feldspar (Or) melt system is a excellent system simulating the natural magma from basalt to rhyolite.

This study intends to understand the change of physical properties (mainly density and viscosity) of silicate melts along the join Di-Or. Special attention should be focused on the viscosity of intermediate composition of this system. The characteristic feature of viscosity of mixed melt will be discussed on the basis of the configurational entropy theory.

Density was measured using the double-bob Archimedian method for high temperature region and the thermal expansion curve by TMA for low temperature region. Following two characteristic features were obtained based on the measurements.

1 Density decreased with increasing temperature and increasing orthoclase component.

2 Thermal expansion coefficient increased rapidly at the glass transition temperature.

Viscosity was measured by the counter-balanced sphere method for high temperature, and the glass fiber-elongation method for low temperature. Following two characteristic features were determined.

1 Viscosity decreased with increasing temperature and increasing diopside component.

2 The additive law was not applicable to this melt system. Viscosity measured for the melt of intermediate composition was lower than that of calculated one based on the additive law.

To understand the physicochemical mechanism of the deviation from the additive law for viscosity mentioned above, the author applied the configurational entropy theory with considering the effect of mixing entropy. As the compositional dependence of the glass transition temperature relates to the change of mixing entropy, the author measured the glass transition temperature using DSC for the estimation of mixing entropy. The calculated values based on the theory for intermediate composition were compared with measured values. It was found that there existed good agreement in the high temperature region, but poor agreement in the low temperature region. One of the reasons for this disagreement in the low temperature region should be the fact that insufficient data were only available for orthoclase melt, important terminal composition. Another reason may be due to the assumption that the configurational entropy at the glass transition temperature is the constant value independent of thermal history of sample melt for the measurement. One of another reason for the disagreement should be due to poor realiability of viscosity data in the low temperature region.