

Development of simultaneous measurement system of viscosity and permeability for highly accurate evaluation of groundwater under high pressure and high temperature condition

*Tomoya Muramoto¹

1. National Institute of Advanced Industrial Science and Technology

In predicting the flow behavior of groundwater, the viscosity of groundwater in the ground under high pressure and high temperature is very important. According to Darcy's law, the volumetric flow rate of groundwater is determined by the balance between "Mobility" and "Driving Force". Here, in order to determine "Mobility", the viscosity of the fluid is required. From this, it can be said that the viscosity of the fluid is very important for accurately predicting the underground flow field.

We developed a new method for the high-pressure viscosity measurement of a fluid using two pressure balances. In this method, the concept of a capillary method used in a viscosity measurement and cross-float technique are applied. We evaluated the pressure dependency of the viscosity of dioctyl sebacate. On comparing our results with the those in the literature, it was confirmed that the result showing the pressure dependence of viscosity was similar to that mentioned in literature. Thus, we confirmed that the measurement system developed in this study could accurately evaluate the pressure dependence of viscosity. In the future, focusing on the similarity between flow field descriptions based on Darcy's law used for permeability measurements and Hagen-Poiseuille's law used for highly accurate viscosity measurements by capillary method, we will develop simultaneous measurement system of viscosity and permeability at high temperature and high pressure. The measurement system to be developed in this study makes it possible to determine the permeability based on the national measurement standard, and to accurately evaluate of the permeability and mass transport characteristics of groundwater.

Keywords: High-pressure, Darcy flow, Viscosity

