Laboratory viscosity measurements combined with textural analyses were performed on the tholeiitic basalt erupted at 1778 from the Izu-Oshima volcano, Japan, to understand the effects of crystals on magma viscosity in relation to textural characteristics. We used the atomosphere-controlled high-T concentric cylinder rotational viscometer at Kobe University. 8 measurements were done at temperature from 1531K to 1395K under Ni-NiO oxgen buffered conditions and a part of melted sample was collected after each measurement, quenched and processed to thin section for textural analyses using a microprobe. The obtained viscometry datasets were analyzed based on Bingham fluid model to determine flow properties.

Crystallization of plagioclase started at ca. 1446K followed by pigeonite at ca. 1413K, and trace amount of augite and magnetite crystallized at ca. 1395K. Crystallinity increased monotonously up to 0.29 as cooling. Bingham viscosity increased from 42 to 1765 Pas and relative viscosity (defined as the ratio of Bingham viscosity to melt viscosity) increased up to ca. 9. Shear thinning behavior was found at temperatures below 1413K (crystallinity above 0.13) and apparent yield stress monotonously increased up to 210 Pa with cooling.

The obtained relative viscosities tend to be higher than those predicted by the Einstein-Roscoe (ER) equation with maximum packing fraction (MPF) of 0.6 and also by the Casta’s equation with any published parameter values. The ER equation successfully explained the obtained dataset with MPF of ca. 0.47. The MPF value is almost consistent with theoretical value for oblate particles with aspect ratio similar to crystals in our samples.