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Studies on the Fluidity of Powder

Kōzō KURIHARA*

Assuming that the flow of powder is Newtonian flow, the apparent viscosities of of powders were determined.

The powder as put into a rotating horizontal cylinder and by this device every part of the powder was kept in a flowing state during the measurement.

From the photographs of the end profiles of powder in a steady state the angles between the free surface of the powder and the vertical line were measured under various rates of rotation and amounts of powder. The relation between the angle and the viscosity was derived theoretically and the validity of the equation was checked with the data of Newtonian liquids.

The apparent viscosity of powder was calculated from the experimental results by adopting the above equation. These results of experiments and calculations suggest that the angle of repose of powder must be taken into account for the estimation of the apparent viscosity of powder.

The powder in the rotating horizontal cylinder was composed from two parts, those are, one moving with the cylinder and the other flowing freely. Although the powder would not be considered as a Newtonian liquid from the above given points, the tendency of the apparent viscosities obtained in our method was in good agreement with that obtained from the Ford-cup measurements.

In order to explain the physical meaning of the above given apparent viscosities, measurements of the fluidity of powder were made with a rotational viscosimeter equipped with blades to prevent slipping of powder at the wall. The experimental facts showed the existence of a discontinuous shear plane in powder and we could not specify the existence of flowing part in powder. Assuming the frictional force operates along the shear plane, a method for the calculation of the kinetic self-frictional angle was presented.

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