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DROPLET DYNAMICS AND VISCOSITY MEASUREMENT OF MODERATE VISCOUS FLUID USING ELECTROSTATIC LEVITATOR

Abstract

An electrostatic levitator is attracted widespread attention because the use of a containerless technique has many scientific and technological merits. It would be promising for an innovative material processing and physical property measurements of materials with extremely high melting temperature or with easily chemical reaction. In order to understand the nonlinear behavior of liquid drop with oscillatory and/or rotational motions, an experimental study was performed. The electrostatic levitator was employed to achieve liquid drop formation on ground. A liquid drop with about 3 mm in diameter was levitated. In viscosity measurement of levitated droplet, there are several methods, which utilize droplet deformation by oscillation or rotation. A drop oscillation method is used for lower viscous liquid and a shape relaxation method is applied to higher viscous one. However, there has been no method to measure moderate viscosity of droplet which ranges from 0.1 to 100 Pa•s because the applicable viscosity ranges of the drop oscillation and the shape relaxation methods is limited, respectively. The objective of this study is to establish new viscosity measurement of levitated droplet. The dynamic motion of levitating droplet of changing from axisymmetrical, asymmetrical shapes, and eventually breakup was observed experimentally. The relation between deformation of rotating droplet and viscosity was examined. New viscosity measurement method was discussed based on the principle of Liquid Filament Rheometer.