

Fluid property measurement for Kitchen Earth Scientists: rheological measurements using DIY falling-ball viscometer combined with image analysis

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We propose a simple rheological measurement using a DIY (Do It Yourself) falling-ball viscometer coupled with image analysis. The simple viscometer consists of a transparent plexiglass cylinder, a rubber plug, and a commercial video camera that we can easily buy on the internet. The rheological properties of not only Newtonian fluid but also Non-Newtonian fluid are obtained in this rheometer. An image sequence of the falling ball in a fluid was captured by the video camera, and the spatio-temporal image was created by a free software, ImageJ. The obtained image could provide the information of rheological properties such as shear rate dependent viscosity, elastic property, and yields stress. In this presentation, we will show some examples: sugar syrup as Newtonian fluid; a mixture of gel beads and water as Non-Newtonian fluid.

We will also demonstrate the flow behavior of a buoyant fluid, whose viscosity is unknown, in a viscous fluid. The apparent viscosity of the buoyant fluid is estimated through the image analysis of its flow motion. Our homemade viscosity measurement using a falling-ball viscometer will provide fruitful information of the rheological properties of the fluid and be useful for the Kitchen Earth Scientists.

Keywords: Rheology, falling-ball viscometer, experiment