

Particle Image Velocimetry in a wide-gap Couette rheometer: Study on a shear-thickening fluid

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ABSTRACT

Experimental data of the rheological behavior of Aerosil® R816/Polypropylene glycol suspensions were obtained with the particle image velocimetry (PIV) technique. This method provided useful information on the local rheological measurements that can be used to validate macroscopic results obtained with standard rheometers and, additionally, to understand the physical implications of such a rheological suspension [1]. The PIV facility was designed and manufactured in a standard wide-gap Couette controlled-stress rheometer (Haake VT550). The novel PIV system consisted of a high speed camera (up to 1000 frames per second) and a 2W continuous laser. This fact improved the time resolution in comparison to other systems. Both the azimuthal velocity profiles and the viscometric properties were measured simultaneously. The device was firstly tested with polypropylene glycol (PPG), a Newtonian fluid, and later some local rheological measurements were performed on a Non-Newtonian suspension obtained by dispersing Aerosil® R816 silica fumed particles in PPG [2]. It was observed that the bulk values of shear rate and shear stress given by the rheometer differed from those obtained with the PIV measurements made on the Non-Newtonian fluid.

[1] F. Blanc, F. Peter, E. Lemaire, Particle Image Velocimetry in Concentrated Suspensions: Application to Local Rheometry, *Appl. Rheol.* 21 (2011) 23735.

[2] F.J. Galindo-Rosales, F.J. Rubio-Hernández, J.F. Velázquez-Navarro, Shear-thickening behavior of Aerosil® R816 nanoparticles suspensions in polar organic liquids, *Rheol. Acta* 48 (2009) 699-708.