Novel Experimental Ultrasound Technique for Determining the Gravitational Stability of Magnetic Fluids/Colloids

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Nowadays, it is well known that magnetic particles of micrometric size present a high magnetic saturation, and therefore they have been widely used for the formulation of magnetorheological (MR) fluids. Regarding the gravitational stability, in MR fluids with micrometric particles the Brownian effect is not enough for the sustenance of these particles, hence it is necessary to use thickening agents to reduce the sedimentation of magnetic particles. However, although this and other strategies have been employed to slow down the settling of particles, stability problems appear after long waiting times. Therefore, the expansion of MR technology has been limited, leading to the need of developing methods to measure the sedimentation rate of MR fluids.

In this work, an experimental method based on ultrasound for determining the stability of magnetic fluids has been developed. The development of this procedure implies the choice of the optimal set-up; the acquisition and processing of data; and the correlation of the ultrasonic waves' physical properties with magnetic fluid gravitational stability parameters and properties. Through the new technique, the stability of different formulated MR fluids has been evaluated, and likewise, this technique has been compared with other techniques already known to determine the stability of magnetic fluids.

The results show that the new procedure has advantages over other techniques, since it has not limitation of concentration of particles, does not modify thermophysical properties of the fluid and is less sensitive to the adjustment parameters of the set-up. This method has proved its effectiveness measuring the settling properties of magnetic particles in a carrier liquid but will be useful also to measure other non-magnetic colloids.