Abstract No: 126 ***Physical Sciences***

MAGNETIC FIELD-INDUCED DEFORMATION OF CASTOR OIL-BASED FERROFLUIDS

R.M.R. Ratnayake*, T.P. Ranawaka and J.P. Liyanage

Department of Physics, Faculty of Science, University of Peradeniya, Sri Lanka
**ravinduratnayake01@gmail.com*

In the field of astronomy, optics is essential and adaptive optics is gaining prominence for its efficiency. This research includes the synthesis and characterization of a castor oil-based ferrofluid and the investigation of the magnetic field-induced deformation of ferrofluids and their potential as a base for liquid telescopes. Depending on the method of obtaining magnetic nanoparticles, the rheological behaviour of the ferrofluid changes significantly. Therefore, to obtain sufficiently small particles, pH level and temperature control were explored. This study proposes a novel surfactant coating method using castor oil as an alternative to oleic acid, given its ricinoleic acid content, which is chemically similar to oleic acid. Castor oil and kerosene are used as carrier liquids, with subsequent characterization of their magnetic and rheological properties. The ferrofluid particle size was studied with scanning electron microscopy (SEM). The rheological properties were studied using Rosensweig instability peaks under the precisely controlled magnetic field of a cavity magnetron electromagnet. The deformation was monitored using optical microscopy and analysed to understand the correlations between the magnetic field characteristics and the resulting deformation patterns. Based on the characterization, the pH control method proved better for obtaining smaller particles, as indicated by the sedimentation rate and confirmed by SEM data. This demonstrated that castor oil is a viable alternative to oleic acid, providing a stable base for ferrofluids that respond effectively to magnetic fields. Castor oil as the carrier liquid proved more stable due to longer response time and stable modelled surfaces. Kerosene, which was more volatile but was more rapid in response to the change in magnetic field, achieving faster response time. Data obtained were modelled using MATLAB, revealing the ferrofluids deformed relative to magnetic field strength. The outcomes of this study may be used as leverage for future studies on tunable liquid surfaces.

Keywords: Ferrofluid, pH control, Rosensweig instability peaks, Telescope mirror surface