Flexible Blade Rheometer (Ramot)

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The Invention

The innovation is a low-cost flexible extension to the standard off-the-shelf rotational blade rheometer. State of the art rotational rheometers use fixed and rigid blades, which rotate against a fluid and have limited accuracy at extremely high or low viscosities. Our inventions replaces the rigid blades with flexible blades work by utilizing fluid mechanics and fluid-blade interaction principles and allow to detect small changes of viscosity. The very small viscosity changes are amplified through the interaction of the thin boundary layers on the sidewalls, the high shear in the small gap between the wall and the blade and on the rotating flexible blade itself.

Advantages

Diluteness of solutions or small concentration of particulate/hazardous add-on causes slight changes in viscosity. As of now, there are no high accuracy cost-effective solutions available for highly viscous fluids and/or at the lower accuracy range of tools. State-of-the-art viscosity measurement principles are i) torque measurement, ii) flow through small vessels and iii) optical assessment of drop formations. These require high precision mechanics, optics and/or electronics which are the main causes of the high cost of these devices.

Potential Applications

Accurate and real-time viscosity measurement of dilute solutions of polymers/dyes/mixtures is one of the applications in processing industries (chemical, food, pharmaceutical, etc.). Rather than purchasing a high cost unit, the existing blade may simply be replaced by the flexible blade on the existing unit (with proper calibration and software).

In the medical applications, the viscosities of blood and urine have long been used as an indicator in understanding and treatment of disease. The advent of modern rheometers allows viscosity measurement with ever-improving clinical convenience. A change in blood rheology and flow properties is often associated with hematological diseases or disorders (e.g., sickle---cell anemia, malaria). Changes in urine viscosity are used to evaluate homeostasis in heart surgery patients and also in tracking renal disorders.

In water/wastewater treatment, multiphase flows and fuels viscosity is a simple indicator of changes. A change of viscosity can be detected in a stream in real-time as well as in a tank.

Patent Status

A US provisional patent was filed in 2011

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