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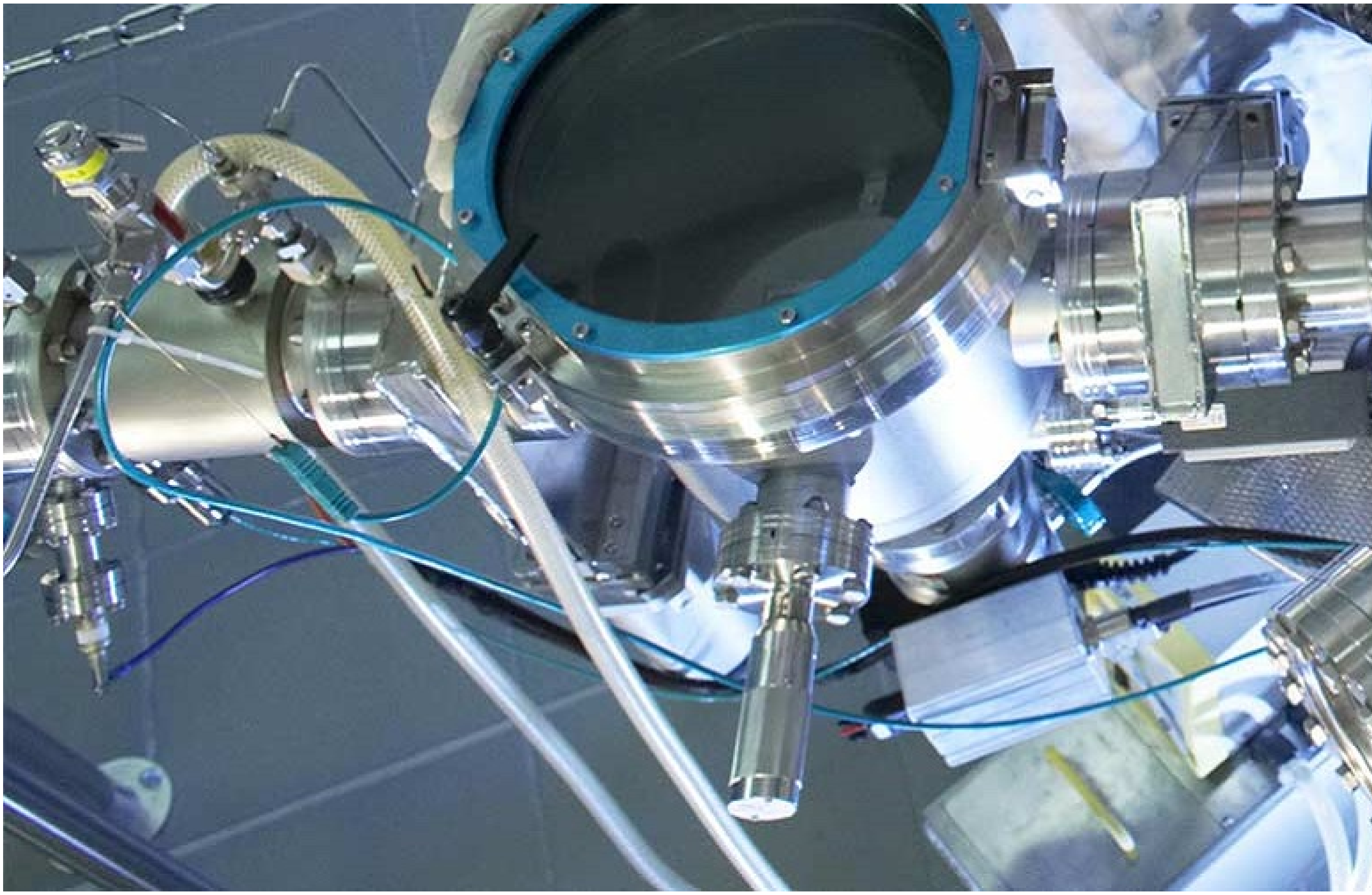


Written on 19 June 2019 2 minutes of reading
News

- Fundamental Research

- [Analysis and characterization]
- [Microfluidics]
- [High-throughput experimentation (HTE)]

Knowledge of the physicochemical properties of fluids, such as viscosity, is fundamental for the development of processes in a broad variety of fields.
Particularly when working with complex systems[a], it is extremely difficult to predict the combined effects of the different components on viscosity; moreover, a large number of experiments are required to measure it: a high-throughput experimentation (HTE) approach is therefore preferable.

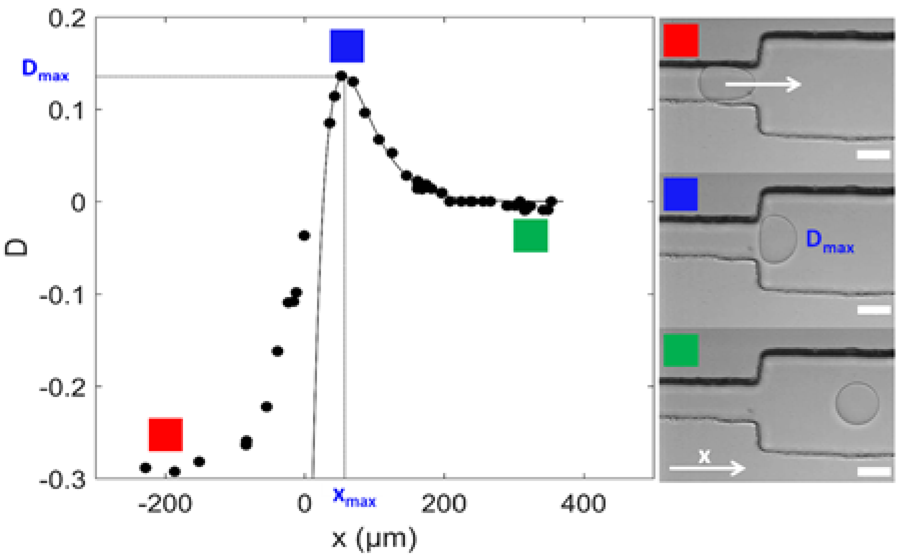
Measuring the viscosity of a large number of samples quickly is a challenge made feasible thanks to digital microfluidics, a technique that handles very small amounts of fluids in the form of droplets forming as many microreactors. But measuring viscosities on the scale of a droplet that is 100 µm in diameter is **a challenge that had yet to be successfully overcome!**

A thesis carried out at IFPEN[1] addressed this problem, using an original methodology based on experimental observations. When a flowing micrometer-sized droplet passes through a constriction, it is deformed (figure below). A correlation exists between the maximum deformation observed and the fluid's viscosity, thereby rendering this property accessible. The phenomenon of relaxation back to the spherical form is increasingly rapid, from 1 to 50 milliseconds, enabling very large numbers of viscosity measurements to be performed using this method.

Moreover, the use of a mixer made it possible to gradually incorporate a constituent into the droplet composition and thus work with fluids of variable viscosities.

This innovative viscosity measurement method was validated on both Newtonian and non-Newtonian systems, in the presence or in the absence of surfactants[2]. As a complement to more traditional techniques, it makes it possible to conduct an accelerated screening of formulations as a function of their viscosity.

Further theoretical research is still required to explain the correlation that the method is based on, as well as from an instrumentation point of view, the ultimate aim being to obtain a fully automated method for measuring viscosity. Nevertheless, **this experimental work is an important component in the methodological arsenal for high-throughput experimentation**.



Deformation of a droplet passing through a microfluidic restriction (at x = 0).
On the images to the right, the white line represents 100 µm.

[a] - *Emulsions, suspensions, polymers in solution, etc.*

[1] **E. André**, Développement d'un outil EHD microfluidique pour la mesure de propriétés physico-chimiques (Development of a microfluidic HTE tool for the measurement of physicochemical properties), PhD thesis, 2018.

[2] **E. André, N. Pannacci, C. Dalmazzone**, A. Colin, Soft Matter, 2019, vol.5, n°4, p. 210.
DOI:10.1039/c8sm02372g

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Event:
> IFPEN Microfluidics 2019 Rencontre scientifique event from 13 to 15 November 2019

You may also be interested in

Microfluidics 2019: From laboratory tools to process development
A microfluidic HTE tool to measure viscosity
19 June 2019

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