Physicists develop new method for manipulating minuscule drops

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Researchers from the University of Twente MESA+ research institute, the Foundation for Fundamental Research on Matter (FOM) and the Eindhoven University of Technology have, in cooperation with industrial partners ASML and Océ, developed a new method for manipulating minuscule drops. The fundamental research can be helpful in completely different fields: from minuscule laboratories on chips, to the semiconductor and oil industries. The research was published today in the leading scientific journal *Nature Communications*.

The researchers from the University of Twente Physics of Complex Fluids department are the global leader in the field of 'electrowetting'. This technology enables you to deform small drops and set them in motion by means of an external electric field. Electrowetting is useful in many fields, such as in lab-on-a-chip technology, optofluidics and display technology.

Marble run

In their research, published today, the researchers reversed the method. They show that you can also use the electric field to slow down drops or bring them to a complete halt.

In their experiments, the researchers let drops slide down over a highly water resistant, inclined surface. By locally applying an electric field on the inclined plane, they succeeded in slowing down drops or even

bringing them to a standstill (see film). Professor Frieder Mugele, who was involved in the research, compares the effect with a marble run: "On a marble run, marbles initially accelerate. If you make a small hole in the run, which is deep enough, and if there is sufficient friction, the marbles eventually come to a complete halt. In our research we do exactly the same thing. In this case, however, the small hole is not a physical hole, but a 'potential hole', generated by an adjustable voltage." The researchers developed a scientific model that accurately describes the observed drop behaviour.

Targeted manipulation

The new method allows scientists to very precisely manipulate small drops. This is ideal for microfluidic systems, such as labs-on-a-chip (small laboratories the size of a chip), applications of which include performing blood tests. This new method allows, for example, for separating drops containing a cancer cell from drops containing another cell. The advantage of the method is that it permits a large flow of drops, while you still remain able to accurately manipulate individual drops (see film), as the scientists demonstrated in an earlier publication this year in the journal Lab-on-a-Chip. In addition, the method can be used for a variety of applications ranging from cleaning chips in the semiconductor industry and conducting research into methods for extracting more oil from existing oil fields.

Provided by University of Twente