MATERIALS world
Incorporating International Mining and Minerals

contents

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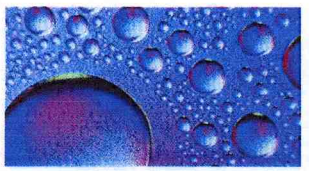


News

Current affairs

The first ever liquid transistor has been created, according to a team of researchers at the University of Cincinnati, USA. Offering major advances in biotechnology and flat panel displays, the new device operates by an 'electrowetting' effect between two competing fluids.

Converting signals

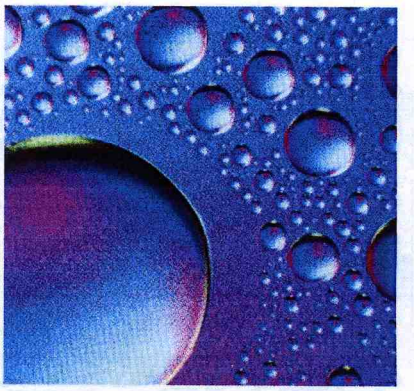
Currently, microfluidic devices are hampered by the crudeness of methods used to turn information conveyed by the movement of a fluid into an electronic signal so that it can be processed by a computer. Signals have traditionally been converted through optical sensing – using a video camera or by exciting fluorescent dyes already present in the fluid. These methods are often cumbersome, expensive and can only confer limited data.

The new device 'is very similar to an ordinary semiconductor FET (field-effect transistor), but operates completely in the liquid state. It can therefore directly convert charge-related information from the liquid state into conventional electronic signals,' explains Dr Andrew Steckl, a Professor at the University of Cincinnati NanoLab and co-creater of the 'LiquiFET'.

Lightning liquids

Steckl and his research partner, Dukyoung Kim, created the instrument by placing a dielectric insulating layer between two electrodes. They then coated the top layer with an amorphous fluoropolymer to act as a hydrophobic insulator. A water droplet, containing potassium chloride to provide better conduction, and a dodecane oil droplet were then placed on top of the structure.

Through the electrowetting effect of the combined liquids, when a voltage is applied across the surface, the oil is pushed away and the water touches the hydrophobic surface. Current is then able to flow between the source of the power and its final destination. Like a regular FET, the current increases as the voltage applied to the gate is raised. When no voltage is applied, the oil layer settles in between the water and the hydrophobic surface, cutting off the current.



Logical applications

'The LiquiFET could serve as the basic building block for a new type of integrated circuit, so-called "Liquid Logic",' says Steckl.

The transistors 'have great potential for bioapplications – they can directly detect, manipulate and analyse liquids, and they can be immersed in liquids,' he adds.

The team intends to improve the electrical characteristics of the device, eventually using it to connect a microfluidic device to an electronic circuit. Website: www.nanolab.uc.edu.

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