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NANO TECH

Nano-Machines Achieve Huge Mechanical Breakthrough

Dublin, Ireland (SPX) Sep 08, 2005

A major advance in nanotechnology with far-reaching potential benefits in medicine and other fields is to be announced at this year's BA Festival of Science in Dublin. Scientists have built molecules that can, for the first time ever, move larger-than-atom-sized objects. Constructing molecular machines capable of performing relatively large-scale mechanical tasks has never been achieved before.

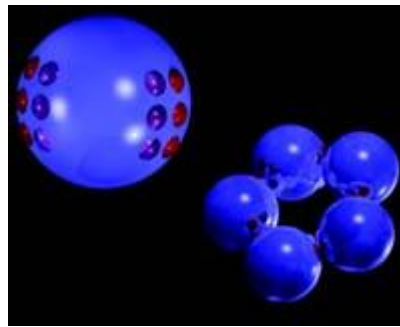


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Now, in an unprecedented breakthrough, chemists at Edinburgh University have used light to stimulate man-made molecules to propel small droplets of liquid across flat surfaces and even up 12° slopes against the force of gravity. This is equivalent to tiny movements in a conventional machine raising objects to over twice the height of the world's tallest building.

This significant step could eventually lead to the development of artificial muscles that use molecular 'nano'-machines of this kind to help perform physical tasks. Nano-machines could also be used in 'smart' materials that change their properties (e.g. volume, viscosity, conductivity) in response to a stimulus. They could even control the movement of drugs around the body to the exact point where they are needed.

The research has been funded by the Engineering and Physical Sciences Research Council (EPSRC), and has also involved scientists in Italy and the Netherlands. David Leigh, Forbes Professor of Organic Chemistry and EPSRC Senior Research Fellow, leads the Edinburgh University team.

David Leigh and his colleagues have achieved their breakthrough by harnessing a natural biological mechanism called 'Brownian motion' (the random movement of molecules caused by collisions with molecules around them). This has involved controlling (or 'biasing') Brownian motion so that molecule movements are no longer completely random.

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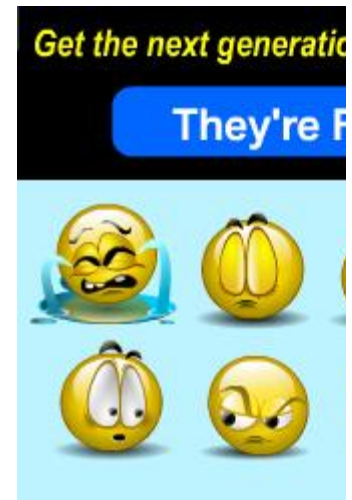
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The team has developed a way of covering a gold surface with specially engineered molecules. When stimulated by ultra-violet light, the components of these molecules change position (this is because a chemical reaction takes place in one part of the molecule that causes it to repel another part).

These changes in position dramatically alter the surface tension of a droplet of liquid placed on the gold surface and in this way produce enough energy to move the droplet a distance of up to a millimetre. It may be the tiniest of movements but in the emerging discipline of nanotechnology this represents a giant technological leap forward.

David Leigh says: "Nature uses molecules as motors and machines in all kinds of biological and chemical processes. Although man's understanding of how to build and control molecular machines is still at an early stage, nanoscale science and engineering could have a life-enhancing impact on human society comparable in extent to that of electricity, the steam engine, the transistor and the Internet."

David Leigh will be discussing his work and showing videos of droplet movement during his talk at the Festival on 7th September. A detailed report has also been published in the latest edition of Nature Materials ('Nanoshuttles move droplets uphill'; Vol. 4, pp.704-710, 2005).

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