# Electrochemical technique follows the motion of individual microparticles in space and time

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(PhysOrg.com) -- Many bacteria are able to 'swim' through liquids by means of a flagellum. When doing this, some bacteria follow attractants, some flee from harmful substances, and others align themselves using light, gravity, or magnetic fields. These processes may also play a role in infections. Following a swimming bacterium without influencing its motion is difficult. Nanotechnology researchers are also interested in determining the motion of nanoparticles, which would be useful for the development of nanomotors, for example.

A team from the Universities of Oxford and Cambridge (UK) has now developed a new, electrochemical method for locating microscale objects as they move through a liquid. As they report in the journal Angewandte Chemie, researchers led by Richard G. Compton were able to use an array of microelectrodes to follow the two-dimensional motion of a tiny, individual basalt sphere in space and time.

The British researchers' new process is based on a simple arrangement of four tiny electrodes (150×150 µm) at the bottom of a small cell. Each electrode can be addressed individually. In order to demonstrate that their approach works, the researchers carried out experiments with a basalt sphere with a diameter of about 330 µm. They used a magnet underneath the base of the cell to move the magnetic basalt sphere. The magnet was positioned by means of a stepper motor.

Inside the cell is a solution containing an electroactive compound. When the sphere comes close to one of the microelectrodes, it gets in the way of the molecules of this compound, which are trying to get to the electrode. This disruption of the diffusion field changes the current response of the electrode. The presence of the sphere is detectable up to a distance of 0.5 mm from the electrode. The sphere was put into many different positions and the corresponding current response curves of the electrodes were recorded. At the same time, the researchers documented the corresponding positions of the spheres with video. This allowed them to calibrate their measurements so that the position of the spheres could be determined by means of the current response curves of the electrodes.

The researchers would now like to reduce the scale of their technique. They are developing electrode arrays for a spatial resolution at the submicrometer level, which would also allow them to follow significantly smaller particles with sub-microsecond resolution.

More information: Richard G. Compton, A Method for the Positioning and Tracking of Small Moving Particles, *Angewandte Chemie International Edition* 2009, 48, No. 13, 2376-2378, doi: 10.1002/anie.200805428

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