
Syncells - Artificial Colloidal Folded 2d Electronic State-Machines - Fabrication and Applications

Technology #19030

Applications

This technology is a small electronic state machine that has applications in environmental and biological sensing.

Problem Addressed

Miniaturized robots have long been sought after as a way of performing tasks in places no human could physically fit or survive, such as inside the human body or in an oil well. The major barrier to realizing micro-bots has been designing electronic circuits on the micrometer scale. These inventors have engineered sub-millimeter sized programmable state machines, called syncells, that are capable of functioning as ram access memory (RAM) devices and aerosolizable electronic sensing devices.

Technology

Syncells are small devices ($<100\mu\text{m}$) composed of two graphene sheets encapsulating 2D electronics, liquid, gel, and nanoparticles. Each syncell can be functionalized by depositing different molecules on each graphene surface or by encapsulating different particles. This allows diverse functionalization of the syncells. These inventors have described two syncell designs engineered to function as RAM devices or environmental sensors. Firstly, syncells that encapsulate liquid exfoliated black phosphorus nano-flakes in the interior of the syncell can function as RAM devices. These syncells create a duo-electrode system that can sense voltages and store the memory of that voltage. A single syncell can store multiple bits of information, and therefore function as a sub-millimeter RAM device. In a second example of syncell design, the inventors engineered MoS_2 syncells to function as an aerosolizable environmental sensor. MoS_2 changes conductive properties upon adsorption of particular molecules, therefore, MoS_2 syncells function as miniature electronic sensors. The inventors describe successful detection of trimethylamine droplets and ammonia gas in the environment through aerosolization and subsequent electronic readout of the syncells. Importantly, syncells are very mechanically and chemically stable, and are able to withstand aerosolization, shear stress, and corrosive environments.

Advantages

- Small ($<100\mu\text{m}$) electronic devices
- Multiple bit RAM storage on a single syncell
- Aerosolizable environmental sensing with electronic readout
- Diverse functionalization through molecule encapsulation or deposition on graphene surfaces
- Mechanically and chemically stable

Categories For This Invention:

Electronics & Circuits

Materials

Micro & Nanotech

Environment

Sensing

Intellectual Property:

Nearly 2D electronic microparticles

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