Water droplets shape graphene nanostructures

Nanotechnology

When asked if a water droplet could be used as a template to fold a single-atom-thick sheet of graphene, assistant professor Petr Kral had a ready answer. "Yes, absolutely," he said.

Kral and his students discovered they could use water droplets to roll, bend, slide and shape graphene into different complex structures such as capsules, sandwiches, knots and rings -- all potential building blocks of nanodevices with unique mechanical, electrical or optical properties.

"Up until now, it wasn't thought we could controllably fold these nanoscale graphenes," said Kral. "But now we know how to shape graphene by using weak forces between the water and graphene sheets." Kral's laboratory is studying potential uses of nanoscale graphene, such as ways to coat it with phospholipid molecules that would allow it to become part of biological cell membranes where it might perform specific functions. His lab is also designing graphene sheet nanoscale membranes for use in desalination and other applications.

While the materials for water and graphene are well known, putting them together in this way to engineer nanoscale devices was not so predictable. "Graphene is a two-dimensional material, and the water is also two-dimensional," said Kral. "How these two-dimensional objects will interact with each other is an open question. It is clear that they should interact, but we don't know the details."

"We're trying to detect signals from the biological world or pass signals inorganic nanostructures with biological cellular systems. This is a new interface, or hybrid system, working together on novel functions." It's a way of evolution to form to the biological world, "he said. "In the future, perhaps proteins will evolve to interact with inorganic systems. It's a way of evolution to form fullerenes, nanodevices, nanodrops, nanoscale technologies, fullerenes, nanodevices, nanodrops, nanoscale systems, nanotechnology, nanomachines."

"Depending on the size of the water droplet and the shape and size of graphene flakes used, we can fold it in different shapes for various applications," said Kral. "It's similar to the way proteins are folded in synthetic ways to coat it with phospholipid molecules that would allow it to become part of biological cell membranes where it might perform specific functions. His lab is also designing graphene sheet nanoscale membranes for use in desalination and other applications.

"We're trying to detect signals from the biological world or pass signals inorganic nanostructures with biological cellular systems. This is a new interface, or hybrid system, working together on novel functions." It's a way of evolution to form to the biological world, "he said. "In the future, perhaps proteins will evolve to interact with inorganic systems. It's a way of evolution to form fullerenes, nanodevices, nanodrops, nanoscale technologies, fullerenes, nanodevices, nanodrops, nanoscale systems, nanotechnology, nanomachines."

"We're trying to detect signals from the biological world or pass signals inorganic nanostructures with biological cellular systems. This is a new interface, or hybrid system, working together on novel functions." It's a way of evolution to form to the biological world, "he said. "In the future, perhaps proteins will evolve to interact with inorganic systems. It's a way of evolution to form fullerenes, nanodevices, nanodrops, nanoscale technologies, fullerenes, nanodevices, nanodrops, nanoscale systems, nanotechnology, nanomachines."