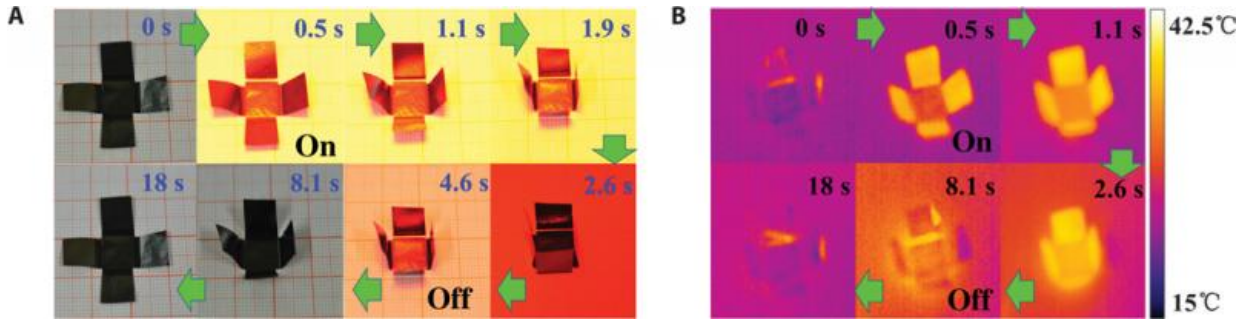
Graphene 'paper' able to behave like animated origami (w/ video)

November 9 2015, by Bob Yirka



A fast self-folding box driven by light. (A) Time profiles of self-folding movements of a cross-shaped piece of paper with and without NIR light irradiation. The sample was placed on the platform and illuminated with NIR light (100 mW cm−2) normal to its surface (light is incident from above). (B) IR images of the self-folding box with and without light illumination (100 mW cm−2, NIR light). Credit: (c) 2015 *Science Advances* (2015). DOI: 10.1126/sciadv.1500533

(Phys.org)—A team of researchers with Donghua University in China has found a way to cause tiny (0.8 to 6 centimeter) objects made of graphene sheets to move around in specific ways using just heat and infrared light—and it is based on origami. In their paper published in the journal *Science Advances*, the team describes the types of graphene they used, the types of objects they created and the ways in which the objects were able to be moved.

The work by the team was inspired by origami, an art form based on folding paper. In this instance, the paper was instead two types of one-atom thick sheets of graphene infused with hydrogen and oxygen compounds resulting in graphene oxide and graphene oxide-polydopamine. The former does not react to water but the second does. To create origami type structures, the team infused the latter with water molecules than bonded the two types of sheets together—when heat or light was applied to the second type, it would cause the water molecules to be released, making the paper shrink slightly, which in turn would exert a force that would pull against the second type of sheet. This allowed for the creation of hinges or joints which could be employed on command, which made the objects programmable in a sense.

To demonstrate the usefulness of their idea, the team bonded sheets together in such a way as to cause a box to self-form. Another example was of a sheet that formed into a worm-shaped object that was capable of inching along a surface—the team found they could cause it to turn by heating just one side of it. The third was a claw-like object that was capable of grabbing onto something else and in some instances was able to lift other small objects.

The researchers believe their research could lead to the development of a wide variety of objects such as remotely controlled robots, tissue engineering or even the development of a type of artificial muscle. For their next project, they want to see if it might be possible to create similar types of objects at a much smaller scale, perhaps down to nanosize—they believe the properties and performance of such tiny objects would be different at such sizes and are eager to find out what they may be.

More information: J. Mu et al. Origami-inspired active graphene-based paper for programmable instant self-folding walking devices,

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