The next graphene? Engineers to study new class of ultra-thin film materials

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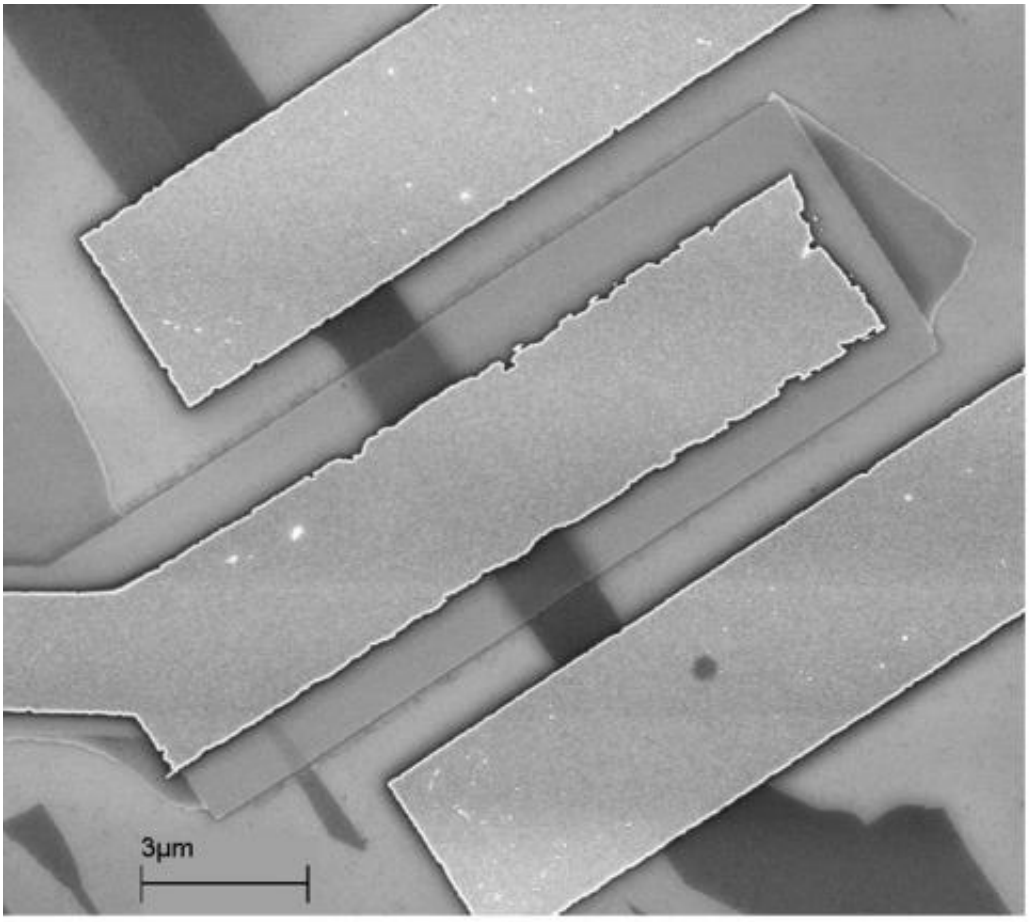

A prototype device with a 2D channel that will be used by the researchers. Credit: UC Riverside

Three University of California, Riverside engineers are part of team recently awarded a nearly $1.7 million grant from the National Science Foundation to characterize, analyze and synthesize a new class of ultra-thin film materials that could improve the performance of personal electronics, optoelectronic devices and energy conversion systems.

The team is led by Alexander Balandin, University of California Presidential Chair in Electrical and Computer Engineering and founding chair of the materials science and engineering program at UC Riverside's Bourns College of Engineering. Other members of the team are Roger Lake, a UC Riverside professor, Alexander Khitun, a UC Riverside research professor, and Tina Salguero, an assistant professor at the University of Georgia.

The project targets a new class of materials, termed van der Waals materials, and heterostructures implemented with such materials. The ultra-thin materials may consist of just one atomic plane, which explains the term "two-dimensional" materials. The project will investigate novel electrical, optical, and thermal phenomena in such materials and heterostructures.

The research is expected to produce new material synthesis techniques and enable practical applications of ultra-thin film materials in electronic switches, optical detectors, low-power information processing and direct energy conversion. The novel devices implemented with the ultra-thin films of van der Waals materials have potential for high speed and low energy dissipation.

The interest to two-dimensional materials was stimulated by the success of the ultimate two-dimensional material known as graphene – a single atomic plane of carbon atoms. Graphene research activities resulted in the observation of new interesting physical phenomena and led to numerous proposals of graphene's practical applications, including

improving the performance of everything from smart phone to batteries to tennis rackets.

Electrical and thermal conduction in graphene substantially differs from that in conventional bulk three-dimensional materials. The unusually high thermal conductivity of graphene was discovered at UC Riverside by a group led by Balandin. The exceptional heat conduction property of this two-dimensional material is presently finding its way to practical applications in thermal management.

Each member of the NSF-funded team will cover different aspects of the research and application of the van der Walls materials.

Balandin will conduct materials characterization, fabrication and experimental testing of nanodevices, Lake will perform the first principal theoretical analysis and computer simulation of the properties of new materials and devices. Khitun will design circuits and systems based on two-dimensional materials and atomic heterostructures. Salguero will synthesize new materials using chemical approaches.

Provided by University of California - Riverside