SI Science International

OPEN ACCESS

News & Comments

Advanced Future Electronics Enabled by Controlled Synthesis of Crystal Flakes

Abdul Khadir Nabeel

In an international collaboration that developed a way to manufacture new, idealized two-dimensional semiconductor materials, researchers believe that the third dimension holds electronics back from becoming thinner, tinier, and more flexible.

A study focuses on the semiconductor indium arsenide (InAs), a narrow bandgap material with high-speed properties and excellent infrared photodetectors. For advanced electronic and optoelectronic applications, InAs are difficult to convert into ultrathin 2D films due to their 3D lattice structure.

The biggest challenge for the team was the growth of large, ultrathin 2D non-layered materials. They solved it by using 2D InAs, because of their properties like high mobility and tunable bandgap. 2D InAs could be a critical material for next-generation, high-performance nano-electronics, nano-photonics, and quantum devices, according to lead scientist Lin Zhou.

This material combines the advantages of both InAs, such as high carrier mobility and direct bandgap sizes, and 2D materials, which are flexible and transparent, and have an ultra-thin nature. It also represents a promising alternative way to further extend the use of 2D semiconductors by incorporating non-layered materials. By using weak atomic attraction - the van der Waals force in epitaxy growth, the team was able to accomplish their goal.

The team tuned the properties of 2D InAs by changing the material’s thickness due to the quantum confinement effect. They also found that 2D InAs can be stacked with other 2D materials to form heterojunctions for multifunction performance, giving them significant advantages in electronics and photovoltaics.

Approximately five nanometers thick triangular flakes of InAs form the final 3D material. A single red blood cell is about 0.0007 of that size. Zhou explained that as the material gets smaller, the devices it eventually comprises will also be smaller.

KEYWORDS

Nano Research, indium arsenide, InAs, 2D materials, 3D lattice, epitaxy growth, nanoparticle, 2D semiconductor, semiconductor indium arsenide