Scientists Develop Flexible Near-Infrared Plasmonic Devices for Wearable Sensors and Medical Imaging Tools

In a significant advancement in nanophotonics, researchers have introduced a new approach to achieving flexible near-infrared plasmonic devices using affordable scandium nitride (ScN) films. This approach, with its potential for scalability, could revolutionize the design of future optoelectronic devices, flexible sensors, and medical imaging tools that rely on NIR light by introducing scalable and cost-effective plasmonic materials.

Plasmonics is a field that leverages the interaction between light and free electrons in metals to create highly confined electromagnetic fields. Traditionally, plasmonic materials have been rigid and possess limited design possibilities. Most of them, like gold or silver, are costly and need more versatility.

Prof. Bivas Saha at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, an autonomous institute under the Department of Science and Technology (DST), demonstrated a method to grow flexible plasmonic structures. They produced ScN layers with exceptional quality and flexibility by pairing scandium nitride with van der Waals layer substrates, materials with weak interlayer interactions, thus introducing a new pathway in plasmonic materials research.

The team used epitaxial growth, in which single-crystal layers are deposited onto a substrate. The technique used stacks of layers of materials with weak interlayer bonding to enable new device architecture (van der Waals heteroepitaxy).

The study, recently published in *Nano Letters*, highlights scandium nitride's potential as a promising plasmonic material for a wide range of applications that require flexibility and precision in near-infrared (NIR) optics, spanning from telecommunications to biomedicine.

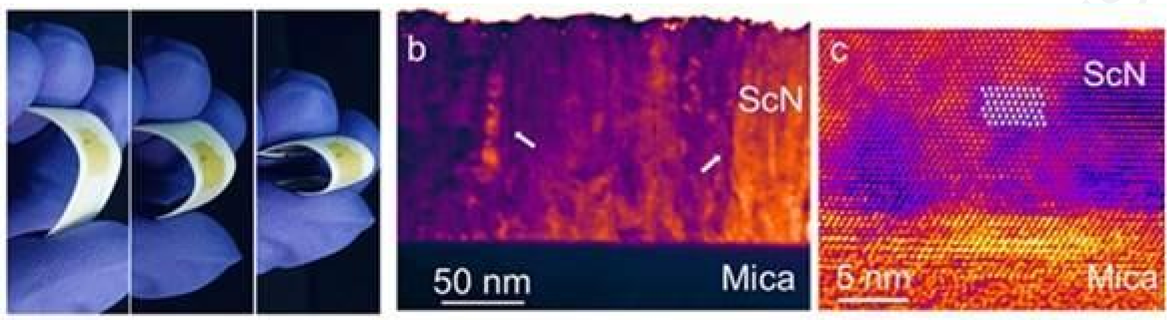
Through precise engineering, the team successfully developed high-quality epitaxial ScN layers on flexible substrates, enabling the propagation of plasmon-polaritons—quasiparticles formed by coupling plasmons with photons—in the near-infrared (NIR) range.

Prof. Saha's team demonstrated that scandium nitride (ScN) is a stable material capable of supporting NIR plasmonics while maintaining performance under bending and flexing, positioning it as a leading candidate for flexible device applications.

"Scandium nitride's stability and compatibility with van der Waals substrates make it an exciting candidate for next-generation flexible electronics. Our findings are a step towards realizing advanced plasmonic devices that are high-performing and adaptable to unconventional applications."

This research holds promise for various industries, from telecommunications to biomedicine, offering a new material foundation for developing next-generation flexible and wearable plasmonic devices. "The results mark a critical step in merging plasmonics with flexible electronics, potentially setting the stage for innovations that leverage the unique properties of near-infrared plasmon-polaritons,"-commented Mr. Debmalya Mukhopadhyaya, the first author of this work.

As plasmonics advances, the innovative application of scandium nitride in Prof. Saha's research highlights the transformative potential of materials science in redefining technological frontiers.



References

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