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FABRICATE GROUP III NITRIDE ALLOYS ON SAPPHIRE

A development at Northwestern University's Center for Quantum Devices will allow designers of optoelectronics devices greater flexibility in the properties of their devices. The ability to design devices using alloys of group III nitrides will extend the range of performance of the nitrides significantly.

Among the emerging semiconductor materials, the group III nitrides such as GaN, InN and AlN have become the leading materials systems for many wide bandgap, short wavelength optoelectronics applications such as blue lasers and LEDs because of their exceptional physical properties. The nitrides have a direct bandgap which is tunable in energy, and can be used in lasers, LEDs, and photodetectors over a range from the ultraviolet to red spectral regions. By fabricating alloys of the nitrides, the tunability and customization of the materials will compare with that of the well-established III-V compounds like AlGaAs.

The Northwestern group had already refined the deposition of epitaxial layers of group III nitrides on sapphire substrates, and extended the process. Using metalorganic chemical vapor deposition, the alloys were fabricated on the sapphire substrates by varying the concentration of Al compounds to produce a variety of configurations of AlGaN.

Once the AlGaN films were created, the scientists created Bragg reflectors with a tunable reflectivity from 330 nm to 456 nm. Their performance indicates that the alloys will be suitable for vertical cavity emitting blue lasers. The scientists also fabricated AlGaN/GaN superlattices, and demonstrated the presence of a two-dimensional electron gas in their devices.

Applications of the nitride alloys include high-density optical storage, high-brightness color displays, undersea and free-space communications, and the detection of spacecraft above the ozone layer where there is a strong visible and infrared background.

The developers are open to licensing and commercial development of their technology.

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