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Toward White LED Light with a New Substrate

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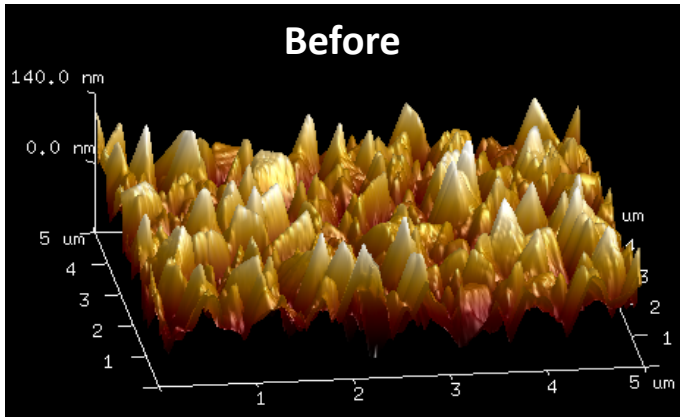
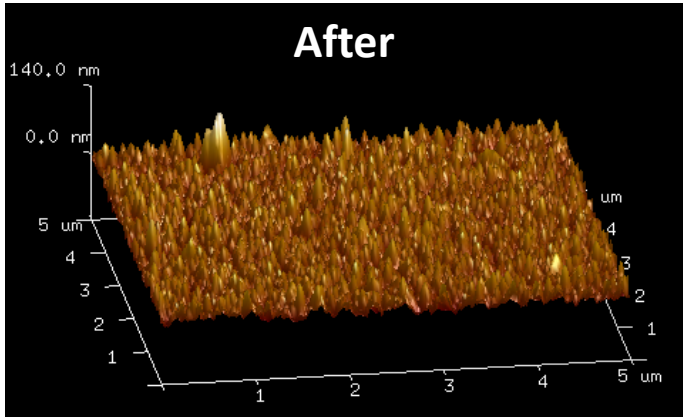
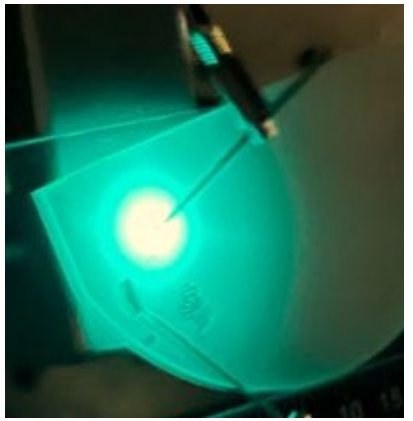
Indium gallium nitride (InGaN) with high In content is needed to enable LED arrays to produce white light at very high efficiency for lighting. However, engineers currently lack a substrate crystal with the right interatomic distances to grow required perfect, smooth, high In content, InGaN films.

Wisconsin MRSEC researchers have developed a new way to synthesize one possible substrate, $ScAlMgO_4$, by depositing it at low temperature, then crystallizing it. Now, the team has developed the ability to grow high-In InGaN on top of $ScAlMgO_4$ using the industry-standard metal-organic chemical vapor deposition process. The films are smoother than films grown on free-standing $ScAlMgO_4$ substrates, which is a critical prerequisite to devices including LEDs, other optoelectronics, and highspeed electronics. The team has developed an InGaN-based green LED device on a conventional substrate that will yield yellow to red light when grown at higher In content on $ScAlMgO_4$.







(Above) Luminescence from an InGaN based green LED structure.

(Left) Surface morphology of InGaN films on $ScAlMgO_4$ on sapphire before and after the seed project research.