Researchers create a smaller, flexible LED

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University of Miami professor at the College of Engineering, Jizhou Song, has helped design an light-emitting diode (LED) light that uses an array of LEDs 100 times smaller than conventional LEDs. The new device has flexibility, maintains lower temperature and has an increased life-span over existing LEDs. The findings are published online by the *Proceedings of the National Academy of Sciences*.

Incandescent bulbs are not very efficient, most of the power they use is converted into heat and only a small fraction of the power gets converted to light. Since LEDs reduce energy waste and present an alternative to conventional bulbs.

In this study, the scientists focused on improving certain features of LED lights, like size, flexibility and temperature. Song's role in the project was to analyze the thermal management and establish an analytical model that reduces the temperature of the device.

"The new model uses a silicon substrate, novel etching strategies, a unique layout and innovative thermal management method," says Song, co-author of the study. "The combination of these manufacturing techniques allows the new design to be much smaller and keep lower temperatures than current LEDs using the same electrical power."

In the future, the researchers would also like to make the device stretchable, so that it can be used on any surface, such as deformable display monitors and biomedical devices that adapt to the curvilinear surfaces of the human body.

More information: The *PNAS* paper is titled 'Unusual Strategies for Using InGaN Grown on Silicon (111) for Solid State Lighting.' Published online before print June 10, 2011, [doi: 10.1073/pnas.1102650108](https://doi.org/10.1073/pnas.1102650108)

Abstract
Properties that can now be achieved with advanced, blue indium gallium nitride light emitting diodes (LEDs) lead to their potential as replacements for existing infrastructure in general illumination, with important implications for efficient use of energy. Further advances in this technology will benefit from reexamination of the modes for incorporating this materials technology into lighting modules that manage light conversion, extraction, and distribution, in ways that minimize adverse thermal effects associated with operation, with packages that exploit the unique aspects of these light sources. We present here ideas in anisotropic etching, microscale device assembly/integration, and module configuration that address these challenges in unconventional ways. Various device demonstrations provide examples of the capabilities, including thin, flexible lighting “tapes” based on patterned phosphors and large collections of small light emitters on plastic substrates. Quantitative modeling and experimental evaluation of heat flow in such structures illustrates one particular, important aspect of their operation: small, distributed LEDs can be passively cooled simply by direct thermal transport through thin-film metallization used for electrical interconnect, providing an enhanced and scalable means to integrate these devices in modules for white light generation.

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