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New approach to low-cost solid state lighting using controlled spalling

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A simple, fracture-based, layer transfer process has been developed and successfully applied to a number of different semiconductor substrate materials. The process is called Controlled Spalling and works by depositing a tensile stressor layer on the surface of a substrate, introducing a crack near the edge of the substrate, and mechanically guiding the crack as a single fracture front across the surface. The entire process is performed at room-temperature using only common laboratory equipment and can even be applied to completed devices. Recently, this process has been used to separate InGaN/GaN multi-quantum well (MQW) light emitting diode (LED) structures that were grown on sapphire substrates. By controlling the stress and thickness of the surface stressor layer, the fracture depth, and thus the layer thickness, can be controlled. Separation of the epitaxial device layers has been made to occur within the n-GaN region, as well as at the GaN/sapphire growth interface. We have also demonstrated successful layer transfer from bulk GaN as well thereby allowing potential reuse of this expensive substrate material.

Biography

Stephen W Bedell received PhD in Physics from the State University of New York at Albany in 1999. He then joined IBM T. J. Watson Research Center as Research Staff Member and has primarily focused on developing advanced semiconductor substrates and materials for high-performance CMOS applications. His publications include over 80 articles in various journals, proceedings, and magazines, and over 150 issued or pending patents. He has received the IBM Outstanding Technical Achievement Award and was named IBM Master Inventor in 2012. He has also given numerous invited and plenary talks and co-edited several conference proceedings.

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