The Triumph of GaN Lighting

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The invention of the transistor inspired research in semiconductor materials other than germanium and silicon, including compound “direct-bandgap” semiconductors that could emit light. It was a student of John Bardeen’s at the University of Illinois, Nick Holonyak, Jr., that explored the alloy engineering aspects of compound semiconductors that led the first demonstration of practical visible-spectrum light emitting diode (LED) in 1962. Since then, several compound semiconductor materials systems have been developed for LEDs, the most important of which is the (Al,Ga,In)N system which demonstrated blue-emitting LEDs for the first time and was awarded the Nobel Prize in Physics in 2014. This unusual material system is now the backbone of the solid state lighting industry, which has changed the display industry, and has now penetrated about 40% of the conventional (i.e., incandescent, fluorescent, discharge) lighting market with enormous savings energy consumption. This presentation will tell this story and also look to what we might expect in the future.

Dr. Mike Krames has 20 years of compound semiconductor materials, device, and applications experience, with emphasis on light-emitting diodes (LEDs) and laser diodes. He has served as Chief Technology Officer of Soraa Inc., Executive Vice President of Advanced Laboratories at Philips Lumileds (previously Lumileds Lighting, a joint venture between Hewlett-Packard Company and Royal Philips Electronics), and has served on numerous advisory boards and boards of directors. His core expertise is in visible-spectrum compound semiconductor (III-V) optoelectronic materials and devices. Dr. Krames played a key role in the launch of the first high-power LED platform for illumination (LUXEON®) and has made many contributions to the advancement of LED technology for solid state lighting in the areas of III-nitride epitaxy, emitter design, down-conversion materials, and applications. Dr. Krames has published over 80 papers and has been granted over 100 U.S. patents. He holds M.S. and Ph.D. degrees in Electrical Engineering from the University of Illinois at Urbana-Champaign, and a B.S. degree in Electrical Engineering from the University of Texas at Austin. He is a Senior Member of IEEE.