Solid State Lighting Research at Sandia National Laboratories

Jerry A. Simmons
Sandia National Labs

Sandia currently is engaged in a large internally sponsored research effort on solid state lighting (SSL). This talk will present an overview of that program, starting with the potential future energy savings that technology will bring about, and the synergisms with related technological needs for national security applications. Highlights of Sandia's research activities will then be presented. Cantilever epitaxy utilizes lateral growth of GaN on patterned sapphire substrates to achieve dislocation densities in the low 107 cm-2 over large areas in a single reactor growth.. A novel nucleation process, controlled by monitoring in-situ reflectance, achieves a dislocation density in the low 108 cm-2 without using a patterned substrate. Both of these new growth techniques enabled dramatic increases in the brightness of our 390 nm InGaN-based LEDs. Other areas where Sandia is working include modeling of Mg activation and H diffusion in GaN, flip-chip LED devices with improved light extraction efficiency, and the use of semiconductor colloidal nanocrystal quantum dots as novel phosphor material for white LEDs.

*Collaborators for this work include A. Allerman, K. Bogart, W. Breiland, R. Briggs, M. Coltrin, R. Creighton, J. Emerson, J. Figiel, A. Fischer, D. Follstaedt, D. Koleske, S. Kurtz, N. Missert, C. Mitchell, L. Rohwer, S. Thoma, and J. Wilcoxon.