Post Silicon Power Semiconductor Devices

Krishna Shenai
Principal Electrical Engineer
Energy Systems Division
Argonne National Laboratory
9700 South Cass Avenue, Bldg. 362
Argonne, IL 60439-4815
EMAIL: kshenai@anl.gov

Wide bandgap (WBG) power semiconductors, including silicon carbide (SiC) and gallium nitride (GaN) promise transformative changes in energy conversion and power management electronics for a wide range of terrestrial and space applications [1]. Unlike silicon, large-scale commercialization of WBG power devices is significantly hindered by excessive material defects which cause poor wafer yield, degraded field-reliability and severe performance de-rating [2, 3]. This paper will provide an in-depth discussion of current state-of-the-art and emerging breakthroughs in WBG material and device technologies in order to "unlock" enormous potential for post-silicon energy conversion and power management applications.

[1] K. Shenai, R. S. Scott, and B. J. Baliga, "Optimum Semiconductors for High-Power Electronics," IEEE Trans. Electron Devices, vol. 36, no. 9, pp. 1811-1823, September 1989.

[2] K. Shenai, "Made-to-order Power Electronics," IEEE Spectrum, vol. 37, No. 7, pp. 50-55, July 2000 (**invited paper**).

[3] K. Shenai, "Switching megaWatts with Power Transistors," to appear in ECS Interface Magazine, Spring 2013 (**invited paper**).