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Semiconductors and nanostructures for energy-efficient electronics

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For over five decades, silicon has served as the industry work-horse for manufacturing energy-efficient electronics in signal, power and sensing applications. In the past three decades or so, there have been major developments in further advancing semiconductor electronics performance and reliability especially when operating in extreme environments using compound semiconductors. For example, silicon carbide (SiC) and gallium nitride (GaN) semiconductors are promising "game-changing" breakthroughs in power switching and power amplification electronics, and show significant potential for post-Moore low-power electronics. This paper will provide a review of the current state-of-the-art in SiC and GaN material technologies for these applications with a focus on material defects; the paper will discuss new material synthesis and nanostructures to overcome key technological barriers that are hindering their large-scale commercialization.

Biography

Krishna Shenai earned his PhD degree in Electrical Engineering from Stanford University in 1986. He is currently a principal electrical engineer within the Energy Systems Division at Argonne National Laboratory in Argonne, IL where he is leading the development and commercialization of wide bandgap semiconductor technologies for signal, power and sensing electronics. He is arguably a leading world expert in the field; his research for more than three decades has provided foundation technologies for several multi-billion dollar industrial product sectors. He is a Fellow of IEEE, a Fellow of APS, and a Fellow of AAAS.

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