Wide Bandgap Semiconductors and High Temperature Superconductors: Key Materials for Future Electric Power Technology

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Electricity, perhaps the most vital infrastructure element in modern society, is undergoing concurrent revolution and growth domestically and worldwide. Electricity is the last of the major service industries to be deregulated, and, at the same time, is experiencing rapid expansion, especially in emerging countries as their economies continue to grow. As this new scenario develops, we enter a period of great uncertainty with only one certainty...the accommodation and control of unpredictable power flow quantities and paths demanded of the transmission/distribution network in the future will require the development and placement of new technologies, amongst them advanced power electronic devices and high capacity power delivery corridors. This talk will focus on two key material technologies I believe essential to satisfying these demands: wide bandgap semiconductors and high temperature superconductors, dissimilar in their physics but synergistic in application and sharing many of the same materials science challenges such as purity of synthesis and control of defects and secondary phase formation. We conclude by discussing a survey of target applications and cost/performance requirements for each.