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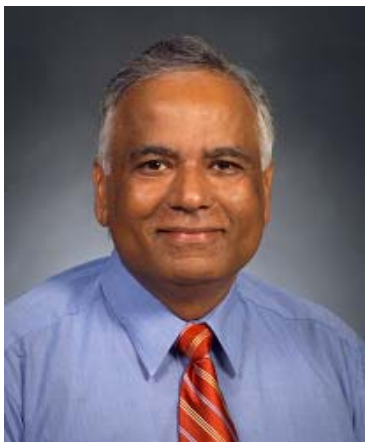

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Materials and Integration Technologies for Alternative and Renewable Energy Systems: Technical Challenges and Opportunities

Global energy demand is projected to sharply rise over the next several decades. Future energy production systems must be sustainable, environmentally conscious, and less reliant on conventional fossil fuels that are associated with a massive carbon footprint. Advanced ceramic materials and multiscale ceramic integration technologies will dramatically impact the energy and environment landscape due to their wide scale applications in all aspects of alternative and renewable energy production, storage, distribution, conservation, and efficiency. Examples include fuel cells, thermoelectrics, gas turbine systems, distribution and transmission systems based on superconductors, nuclear power generation, NOx and COx reduction technologies, and a wide variety of green and energy efficient manufacturing processes and technologies. Affordable and reliable solar energy technologies could also play key role in sustainable development around the globe without major impact on environment since solar power is a clean, renewable, and sustainable energy source. However, revolutionary approaches for thermal energy storage (TES) system at elevated temperatures (>700 ˚C) for concentrated solar power (CSP) are needed for reliable energy supply. Integration technologies are key to making these systems a reality. In this presentation, various challenges and opportunities in design, fabrication, and testing of integrated systems will be discussed. Specific examples will be given for integration of fuel cell systems, thermal management, and thermal energy storage devices. Potential opportunities and need for the development of innovative design philosophies, approaches, and integrated system testing under simulated conditions will also be discussed

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