

EEE-AM 2023 Special Session 04

TITLE

Strategies, smart materials and sensors for energy and safety

SESSION CHAIRS

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DESCRIPTION

In a world marked by rapid technological advancements and increasing concerns about energy efficiency and safety, the integration of strategies, smart materials, and sensors has emerged as a pivotal solution. These three components synergistically contribute to achieving enhanced energy utilization and improved safety standards across various sectors.

Strategies for Energy Efficiency: Efficient energy utilization stands at the forefront of sustainable development. A variety of strategies have been devised to optimize energy consumption across industries and daily life. One prominent approach is demand-side management, which involves adjusting energy usage patterns to balance supply and demand. This is facilitated by employing technologies such as smart meters and energy management systems. Additionally, the integration of renewable energy sources, like solar and wind, into the power grid further enhances energy sustainability. Demand-response systems, which enable consumers to actively adjust their energy usage during peak times, contribute to load balancing and reduce strain on the grid.

Smart Materials Revolutionizing Efficiency: Smart materials play an instrumental role in achieving energy efficiency goals. These materials have properties that can be altered in response to external stimuli, such as temperature, light, or voltage. Shape memory alloys, for instance, can change shape in response to temperature changes, offering applications in energy-efficient heating and cooling systems. Thermoelectric materials convert heat into electricity, holding promise for waste heat recovery in industrial processes. Photovoltaic materials, such as perovskite solar cells, have shown tremendous potential for harnessing solar energy due to their low-cost fabrication and high efficiency. These materials are driving advancements in energy-efficient technologies across sectors.

Sensors Enhancing Safety: Safety concerns encompass a wide array of domains, ranging from infrastructure and transportation to personal well-being. Sensors are pivotal in detecting and mitigating potential hazards, contributing to an overall safer environment. Structural health monitoring systems employ sensors to assess the condition of buildings, bridges, and other critical infrastructure, ensuring timely maintenance and preventing catastrophic failures. In the automotive industry, advanced driver assistance systems (ADAS) utilize sensors to detect obstacles, monitor blind spots, and enable autonomous features, enhancing road safety. Wearable sensors, on the other hand, monitor vital signs and provide early warnings for potential health risks, enabling proactive medical interventions.

Convergence for a Sustainable Future: The convergence of strategies, smart materials, and sensors presents an opportunity to address energy and safety challenges holistically. For instance, building management systems can integrate smart materials to regulate temperature and lighting based on real-time sensor data, optimizing both energy usage and occupant comfort. In the realm of transportation, the fusion of sensors with lightweight materials can enhance vehicle safety while reducing fuel consumption through weight reduction. As these elements continue to evolve, interdisciplinary collaborations between researchers, engineers, and policymakers are essential to unlock their full potential. Through innovative approaches, Strategies, smart materials and sensors collectively drive sustainable development, shaping a future where technology not only optimizes energy usage but also safeguards lives and assets.