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Engineering Strategies Towards Improvement in Energy Storage Performance of Ceramic Capacitors for Pulsed Power Applications

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Abstract : The necessity for efficient and cost-effective energy storage devices to intelligently store the inconsistent energy output from modern renewable energy sources is peaked today. The scientific community is struggling to identify the appropriate material system for energy storage applications. Countless contributions by researchers worldwide have now helped us identify the possible snags and limitations associated with each material/method. Energy storage has attracted great attention for its use in portable electronic devices military field. Different devices, such as dielectric capacitors, supercapacitors, and batteries, are used for energy storage. Of these, dielectric capacitors have high energy output, a long life cycle, fast charging and discharging capabilities, work at high temperatures, and excellent fatigue resistance. The energy storage characteristics have been studied to be highly affected by various factors, such as grain size, optimized compositions, grain orientation, energy band gap, processing techniques, defect engineering, core-shell formation, interface engineering, electronegativity difference, the addition of additives, density, secondary phases, the difference of Pmax-Pr, sample thickness, area of the electrode, testing frequency, and AC/DC conditions. The data regarding these parameters/factors are scattered in the literature, and the aim of this study is to gather the data into a single paper that will be beneficial for new researchers in the field of interest. Furthermore, control over and optimizing these parameters will lead to enhancing the energy storage properties.

Keywords : strategies, ceramics, energy storage, capacitors
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