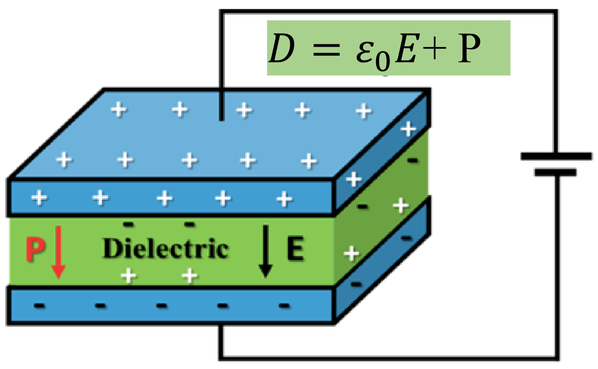
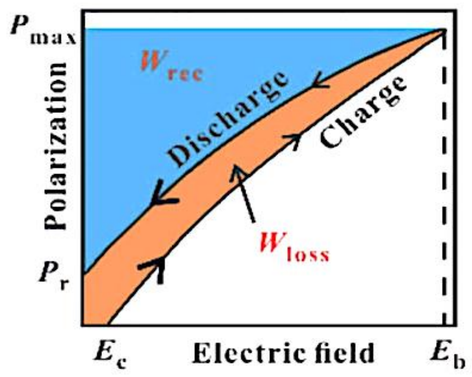
Energy Storage Research Group

Significance and mechanism of dielectric capacitors

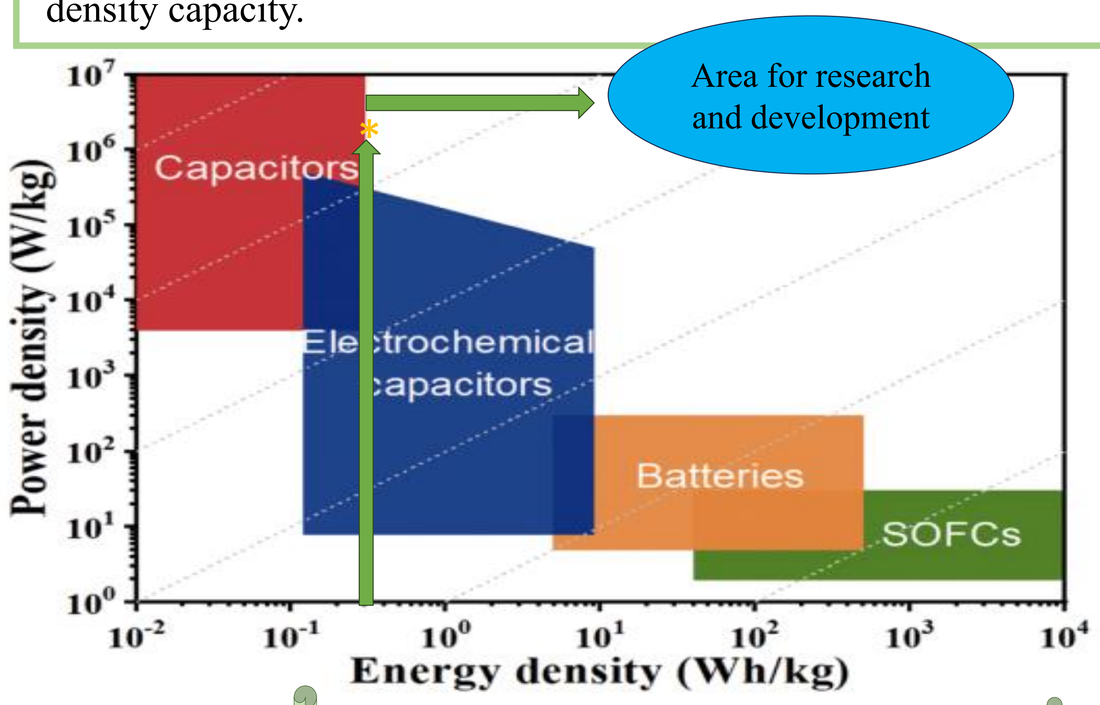




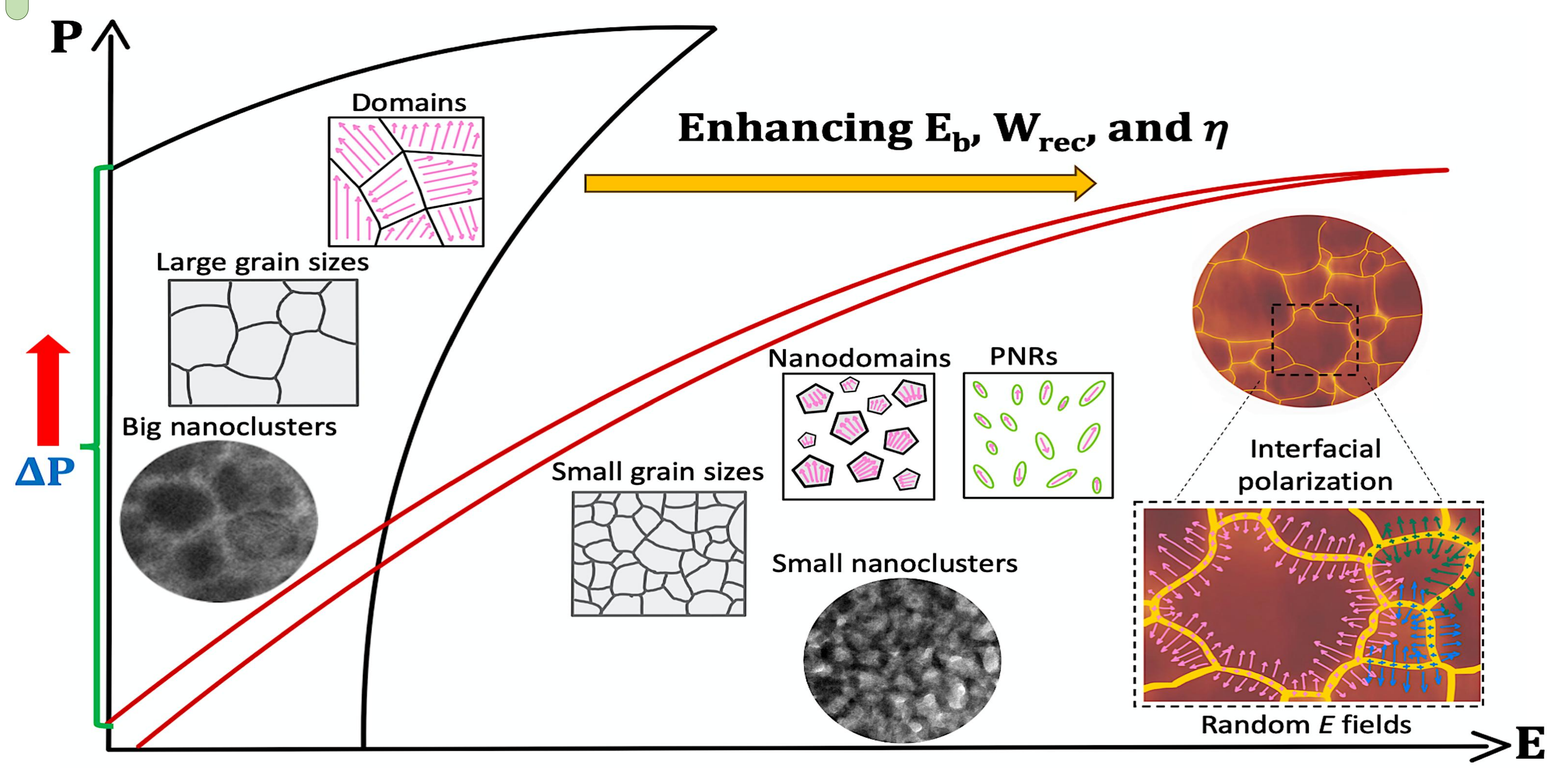
Thus, a larger P_{max} and a smaller P_r (or larger $\Delta P = P_{max} - P_r$) can result in a higher W_{rec}. Large P_{max} can be achieved applying a higher E field, which prompts researchers to explore strategies for enhancing the electric breakdown strength (E_b).

$$W_{rec} = \int_{P_r}^{P_{max}} E \, dP$$

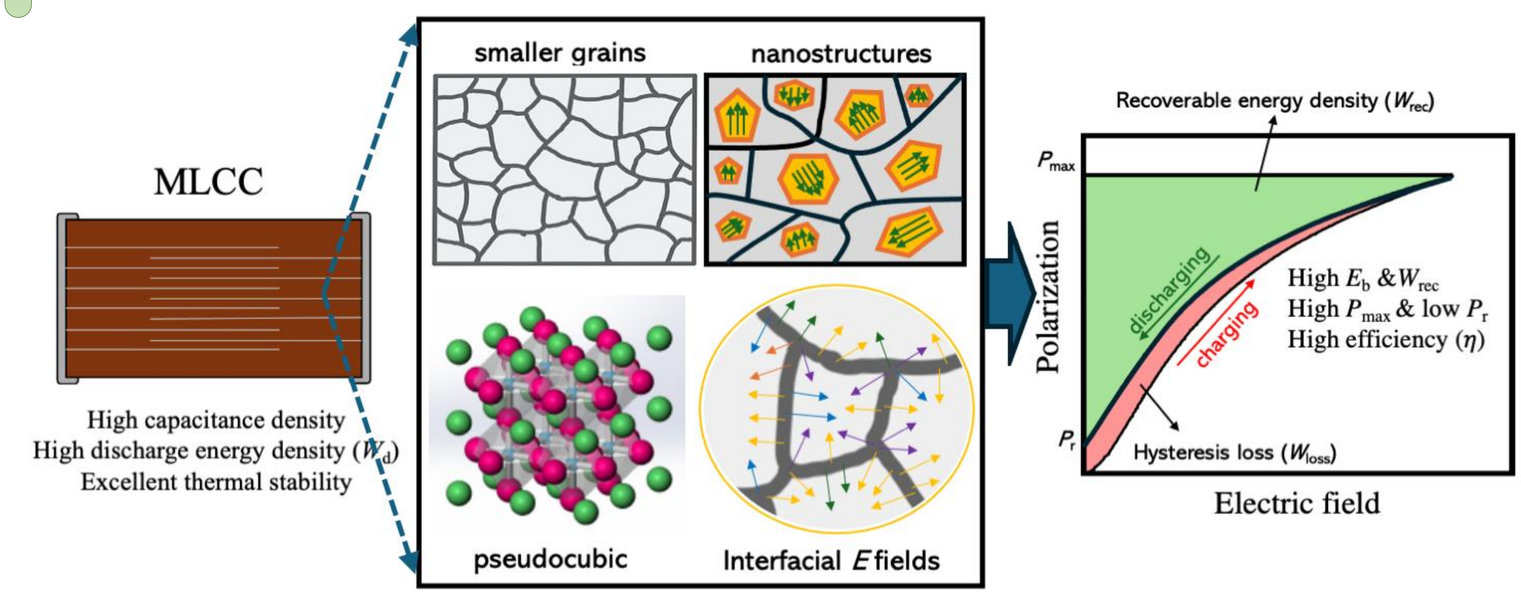
Dielectric capacitors are energy storage typically used for storing electrical energy. It exhibits the fastest charge-discharge mechanism (high powder density) among all energy storage systems. However, its application is limited due to its relatively lower energy storage density capacity.



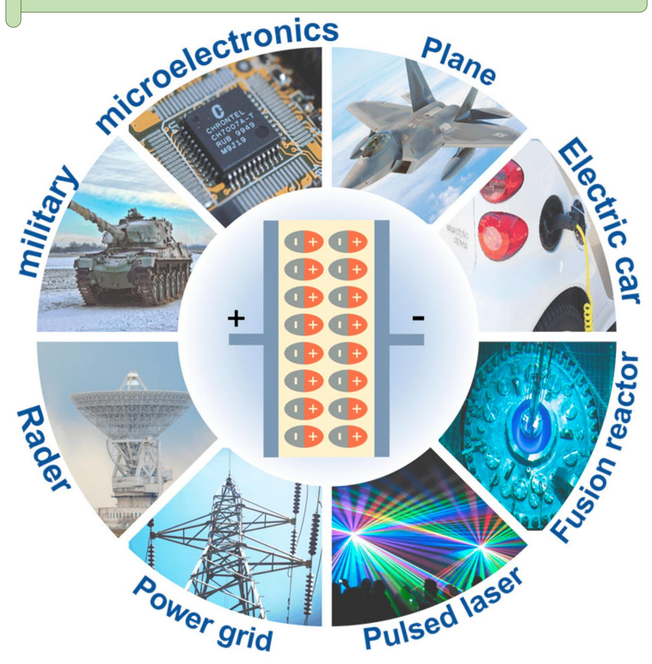
In this research group, we aim to optimize a relaxor ferroelectric (RFE) dielectric material via domain engineering, dopant introduction, and configuration entropy.



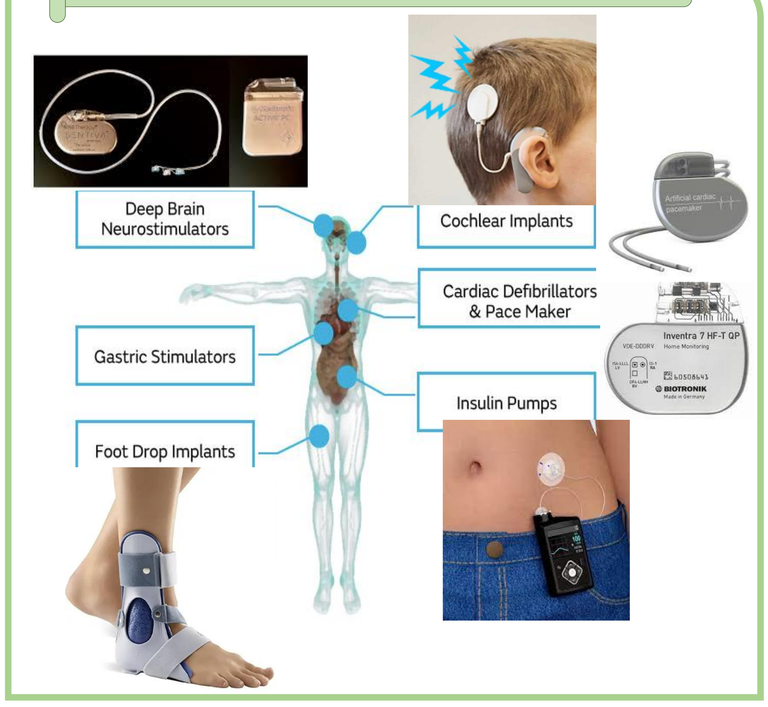
The optimized dielectric material is fabricated into multilayer ceramic capacitor (MLCC) chips for actual device application. MLCC allows further improvement of the energy storage properties of the dielectric capacitor, enhancing the overall performance.



Application in different fields



Application in medical field



Research group members

Publications

- Ultrahigh energy storage in multilayer $BiFeO_3$–$BaTiO_3$–$NaTaO_3$ relaxor ferroelectric ceramics. ***Journal of Materials Chemistry A***, *12*(44), 30642-30654.
- Configuration-entropy effects on $BiFeO_3$–$BaTiO_3$ relaxor ferroelectric ceramics for high-density energy storage. ***Journal of Materials Chemistry A***, *12*(20), 11995-12008.
- Achieving superb electric energy storage in relaxor ferroelectric $BiFeO_3$-$BaTiO_3$-$NaNbO_3$ ceramics via O_2 atmosphere. ***Journal of the European Ceramic Society***, *43*(16), 7446-7454.
- Tailoring energy storage in Nb2O5-added $0.7BiFeO_3$–$0.3BaTiO_3$ ceramics via A-site Gd^{3+} substitution. ***Journal of Alloys and Compounds***, *963*, 171144.
- Optimizing energy storage under low electric field in A-site dysprosium modified $BiFeO_3$-$BaTiO_3$ ceramics. ***Journal of Alloys and Compounds***, *983*, 173918.