Dielectric Phenomena in Polymers and Multilayered Dielectric Films

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High dielectric constant and low dielectric loss are desirable electrical properties for next-generation polymer dielectrics that show promise for applications in pulsed power, power electronics, and printable electronics. Unfortunately, the dielectric constant of polymers is often limited to 2-5, much lower than that of inorganic dielectrics, because of the nature of hydrocarbon covalent bonds for electronic and atomic polarizations. It is essential to understand the fundamental physics of different types of polarization and the associated loss mechanisms in polymers. In this Perspective, we discuss the characteristics of each polarization and explain how to enhance the polarization using rational molecular designs without causing significant dielectric losses. Among various approaches for high dielectric constant and low loss polymers, the multilayer film technology is of particular interest because a multilayer film is a unique one-dimensional system with tailored material choices, layer thicknesses, and interfaces. By minimizing the disadvantageous polarizations and enhancing the advantageous polarizations, multilayer films hold promise as advanced dielectrics for future polymer film capacitors.

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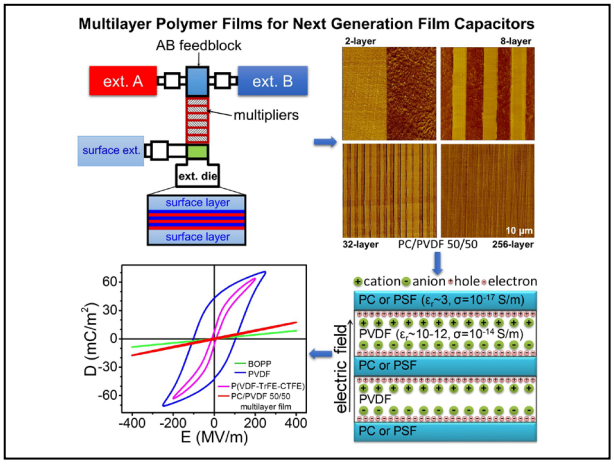

Multilayer polymer films for next generation film capacitors.

Author Biography:

Prof. Zhu received his Ph.D. degree in Polymer Science from University of Akron in 2000. In 2002, he joint Institute of Materials Science at University of Connecticut, as an Assistant Professor. In 2009, he moved to Department of Macromolecular Science and Engineering at Case Western Reserve University. In 2013, he was promoted to full Professor.

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Research Interest: High dielectric constant polymers and organic-inorganic hybrid materials for advanced electrical and power applications