



GENERAL ATOMICS
Energy Products

**COMPACT PULSE POWER
MULTI-UNIVERSITY RESEARCH
INITIATIVE**

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Capacitive Energy Storage

- Double-layer
- Electrolytic
- Ceramic, mica, glass, diamond, & other inorganic dielectrics
- Polymer film, paper, and other organic dielectrics



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Film Capacitors

- Polymer films with optimized self-healing electrodes are now used at electric field values (400-600 V/ μm) approaching their small-area breakdown strength (500-700 V/ μm).
- High-K films are not commercially available.
- PVDF (K \sim 10) is ferroelectric.



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Energy Density

- Energy = $\frac{1}{2} C V^2$
- $C = \epsilon_0 k A / s$
- $V = E s$
- Volume = $A s /$ (packing factor)
- Energy density = Energy / Volume
= $\frac{1}{2} \epsilon_0 k E^2$ * (packing factor)
- Factors k and E are, in the limit,
materials properties



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Fundamental Materials

Questions

- Can high-K, high-E polymer films be made that are not ferroelectric ?
- What are the fundamental breakdown mechanisms in thin polymer films, and can the apparent limits be increased ?
- What is the optimum performance material for self-healing electrodes ?



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