

PolyK Technologies

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- Specialized in high voltage polymer dielectric, ferroelectric, and smart materials and their applications (capacitors, sensors, and actuators)
- Unique high voltage dielectric test facilities
- High temperature ultrathin polymer film production capability
- High energy density film capacitor



High dielectric constant high temperature polymers



Ultrathin Capacitor Film with High Dielectric Breakdown



High energy density capacitors



Capacitors for Railgun



Capacitors for High Power Microwave



PolyK R&D, State College, PA

Integrated Capacitor Manufacturing

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- One of few companies in the world with vertically integrated expertise and capabilities in the entire capacitor supply chain: from new dielectric materials development, to capacitor film production, and capacitor winding/packaging.
- Innovative materials and film development guided by Integrated Computational Material Engineer (ICME) modeling based on specific mission conditions.

High temperature film extrusion
(450 mm, autogauge die)



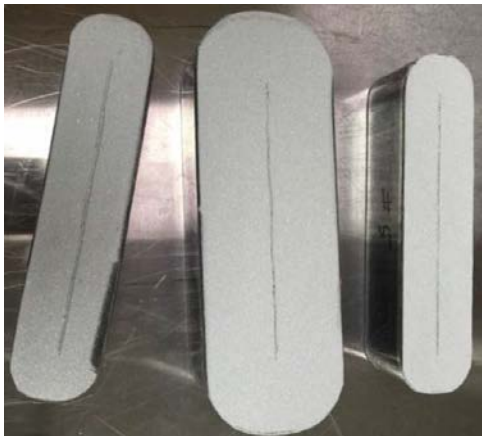
Roll-to-roll film
orientation (650 mm)



Capacitor Winding:
Large Size Capacitors



3,000 sf manufacturing cleanroom with capacitor film extrusion, orientation, and capacitor winding in one place.



Integrated and interdisciplinary approaches lead to advanced film capacitors with high energy density, high power density, and high operation temperature.

Broad application in directed energy weapons systems and power electronics with SiC/GaN WBG switches

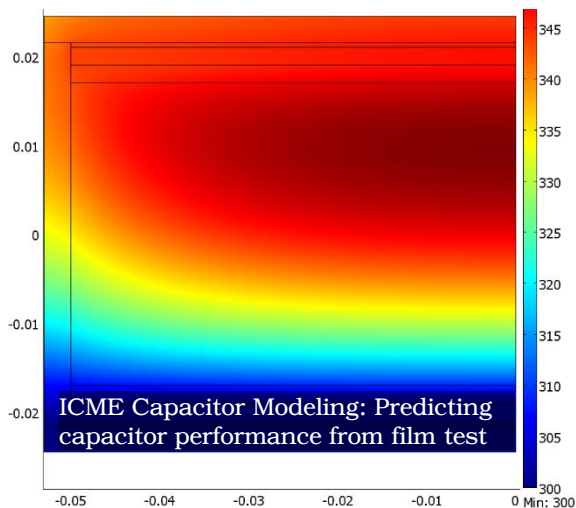
Advanced capacitors will enable the miniaturization of many military electrical systems with enhanced reliability and energy saving.

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Comprehensive Test Lab

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- Comprehensive test lab for materials & film performance (thermal, dielectric, high voltage, morphological).
- Unique capabilities to test high voltage performance of small (10 pF) and large capacitors (1 mF) → all home design/built enabled with LabView® control program.



- Capacitance/DF under DC bias
- Polarization vs temperature
- Capacitor aging and leakage current

- Capacitance and DF vs frequency and temperature
- Capacitor charge-discharge: quantitatively monitor the voltage and current
- Dielectric breakdown strength test

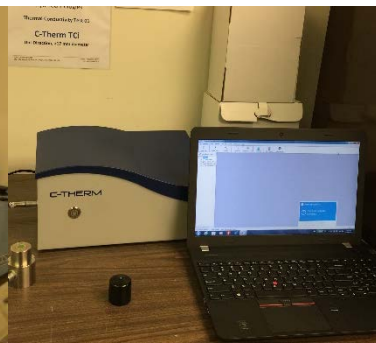
FTIR with polarizer for film morphology and chemical composition



DMA for mechanical modulus & thermal shrinkage (liquid nitrogen to >500 C)



DSC Q2000 Modulated with Autosampler



Thermal Conductivity Test

Gold Sputtering and Corona Treatment



Aluminum Evaporation



100 W CO₂ Laser (600 mm x 900 mm stage)



500 °C Vacuum Oven

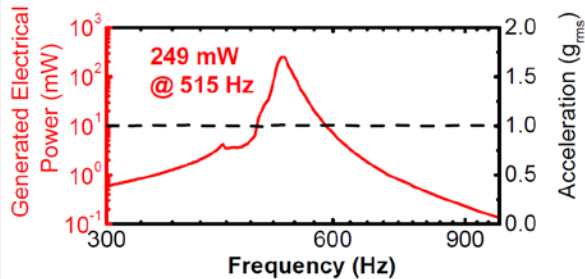
Complete ICME modeling-guided dielectric material screening in-house before moving to pilot production.

Hybrid Piezoelectric Energy

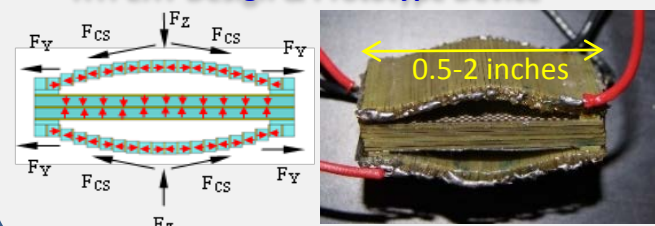
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Harvesting Collaboration with National Institute of Aerospace NIA

Resonance mode at 1.0 g_{rms} acceleration with 200 gram proof mass: 249 mW electrical power

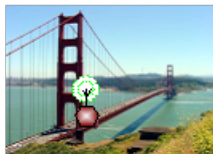


HYPEHT Design & Prototype Device

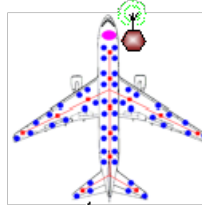


IDTechEx
Winner 2011
Best Technology Development
of Energy Harvesting

Bridge Monitoring



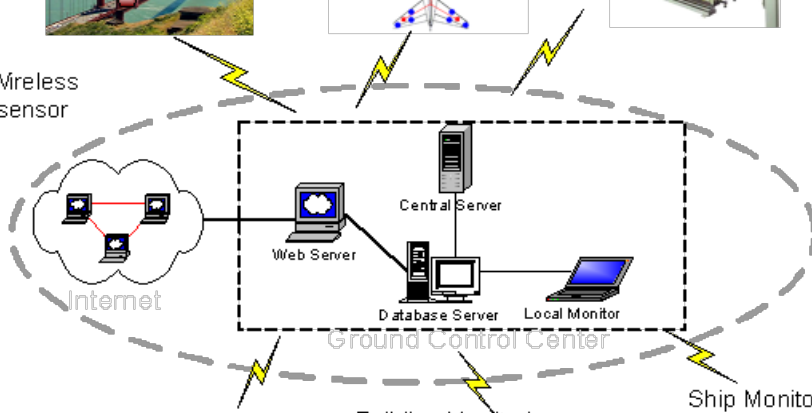
Aircraft Monitoring



Machine Monitoring



Wireless sensor



Automobile Monitoring



Building Monitoring



Ship Monitoring



ENERGY
HARVESTING
& STORAGE

Winner

Best Technical Development
within Energy Harvesting
and Storage

IDTechEx Show!

USA 2015

Looking for Customers/Collaborators

- Develop applications using the advanced hybrid energy harvesting devices to provide power for your sensor systems
- Capable of designing the structure to meet certain force, frequency, and geometry requirements

Applications

- Power for medical devices
- Power for wireless sensor network
- Aerospace and military
- Power personal electronics

Development at PolyK was supported by an NSF STTR Phase I Award No.: IIP-1346385

Innovation

- Convert mechanical energy (vibration, walking, etc) to electrical energy
- High energy and power density comparing with competing commercial piezoelectric energy harvesting technologies
- High energy conversion efficiency
- Provide electrical power to various devices and sensor
- Award winning technology protected by several issued US patents