



Kevin Keefe, ENrG Inc.

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# Flexible Ceramic Applications





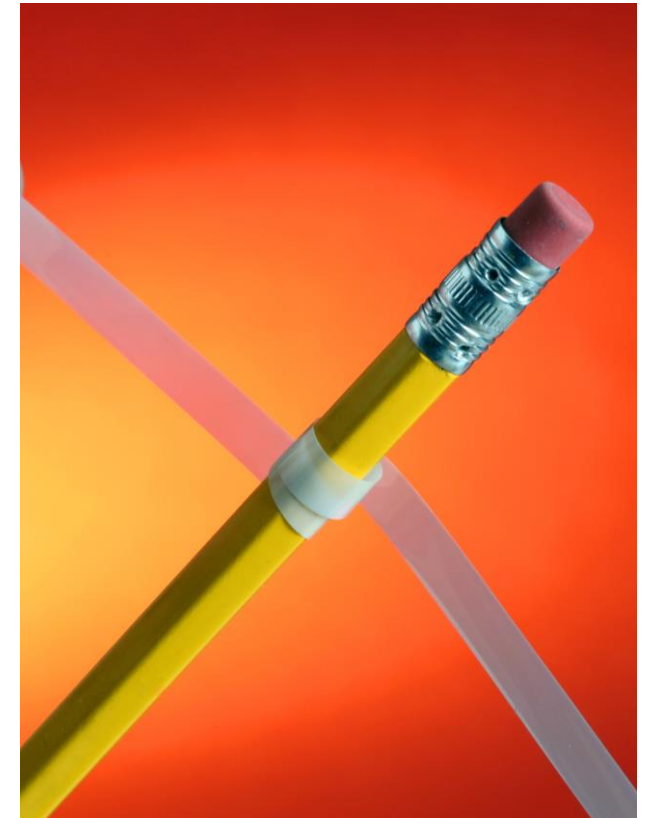
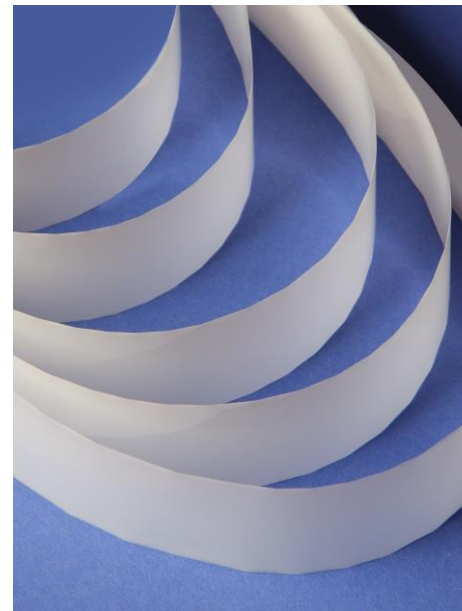
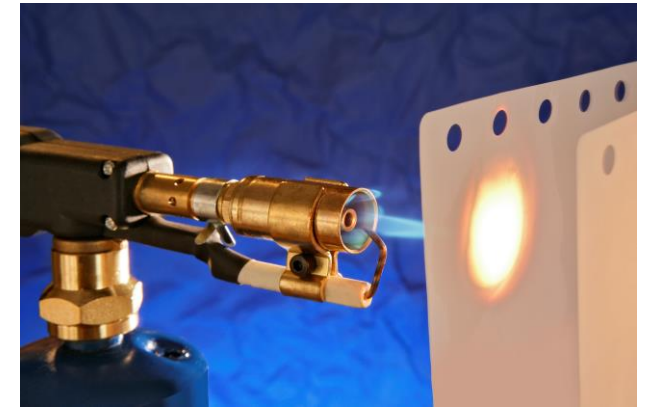
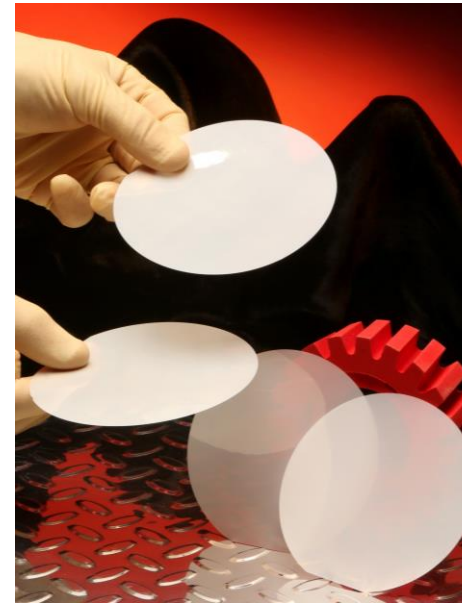
# ENrG's Zirconia Ribbon Ceramic

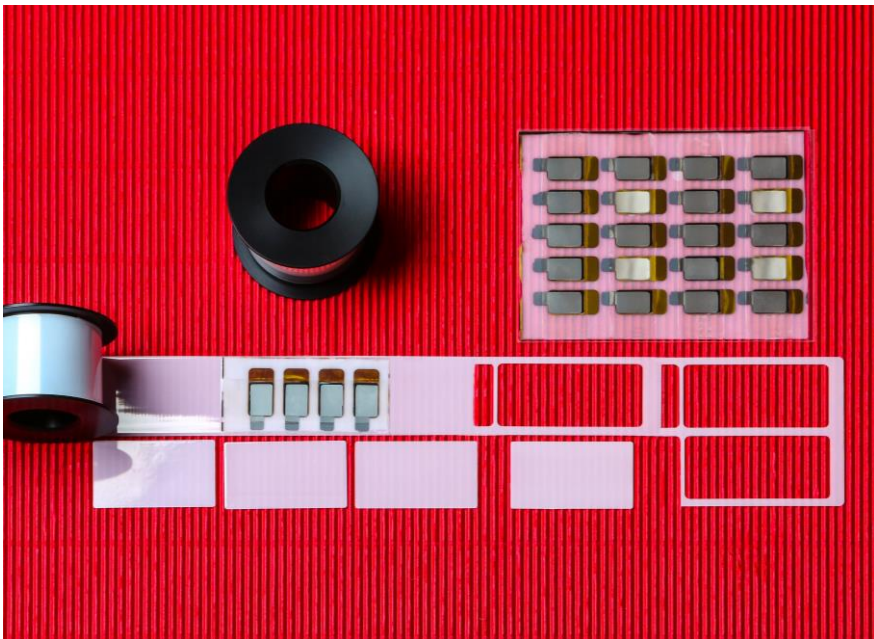
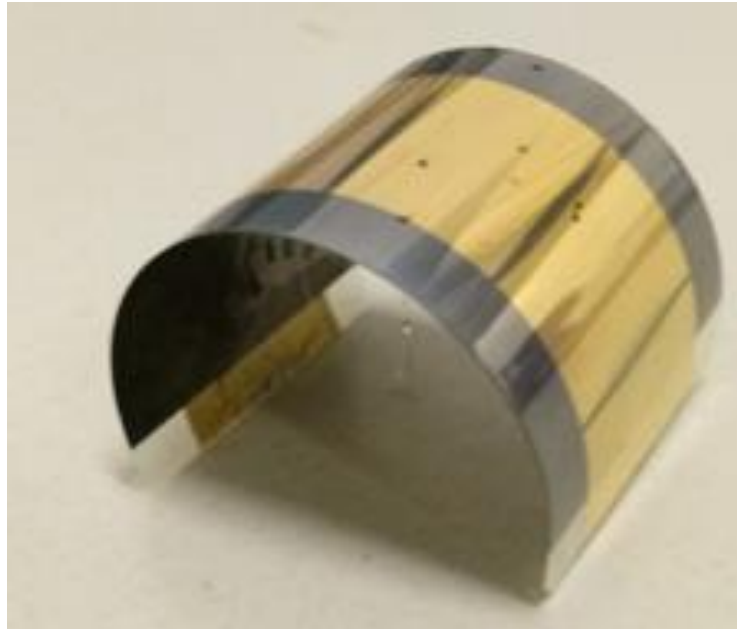
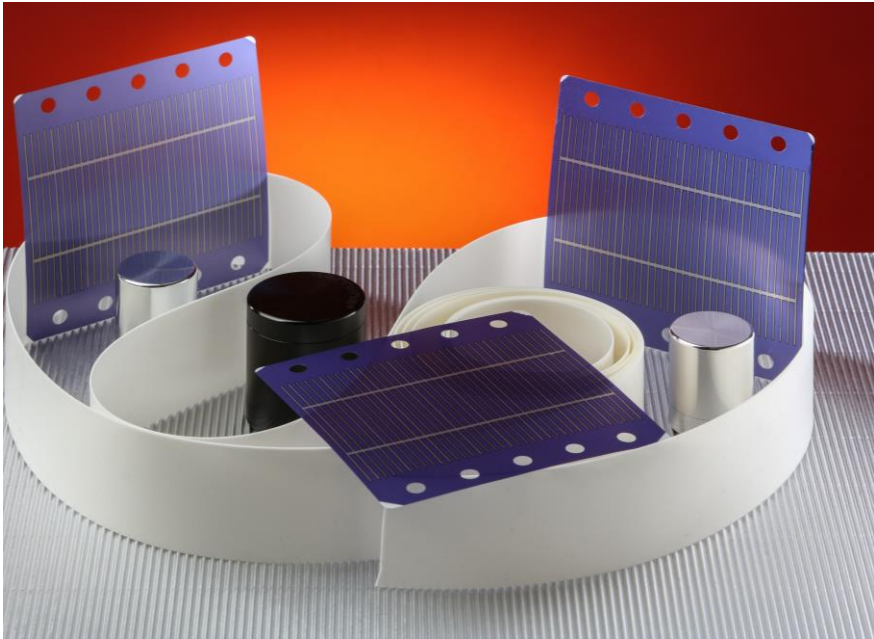
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- World's first Roll-to-Roll (R2R) ceramic substrate.
  - Ultra-thin, dense, flexible ceramic substrate.
  - Available in:
    - Thickness: 20 & 40 $\mu$ m
    - Widths: Up to 100mm
    - Lengths: Custom up to 30m
- Provides device fabricators with the benefits of ceramic substrates in a revolutionary R2R format.
  - High Temperature Capabilities
  - Chemically Inert
  - Ultra-Moisture & Air Barrier
  - Thermal Shock Tolerant

# Zirconia Ribbon Ceramics: Material Properties

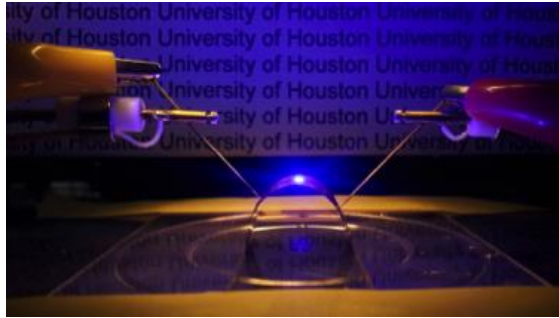
	Property	Measurement
<b>Physical:</b>	Material	3mol% Yttria-Stabilized Zirconia (3YSZ)
	Surface Roughness	20-25 nm
	Density	6.04 g/cm <sup>3</sup> , 99% dense
	Surface Energy	53.96 dyne/cm
	WVTR	1.5 ± 0.9x10 <sup>-6</sup> g/m <sup>2</sup> /day (45°C/85%RH)
<b>Mechanical:</b>	Bend Strength	1.2 GPa, measured on 2 cm strip, 20 microns
	Compressive Strength	2500 MPa @ RT
	Fracture Toughness	7.0 MPa x m <sup>1/2</sup>
	Tensile Strength	248 MPa @RT
<b>Thermal:</b>	Processing Temperature	≤ 1200°C up to 2 hrs.
	Operating Temperature	Up to 1000°C
	Bulk Thermal Conductivity	2.7 W/mK
	Coefficient of Thermal Expansion	8.2ppm @ RT, 10.7 ppm @ 1000°C
<b>Electrical:</b>	Dielectric Constant	28 @ 2.6 GHz
	Dielectric Strength	3200 VDC @ 40µm, 2500 VDC @ 20µm (R.T.)
	Df	0.0048 @ 2.6 GHz
<b>Optical:</b>	Translucent	15% dispersive @ 40 microns
	IR Transparent	80% between 2-7 nm



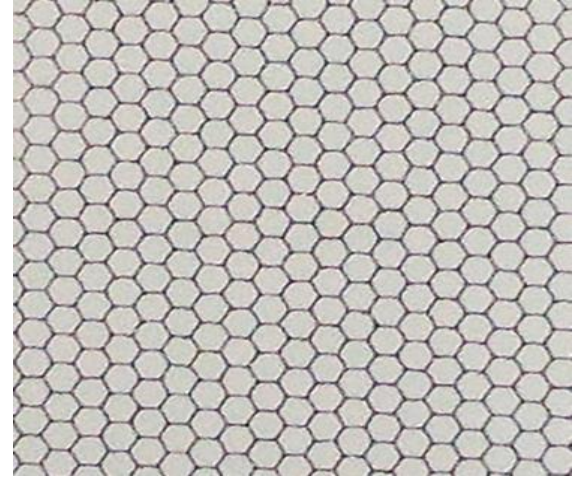


# Solid-State Batteries & Flexible Photovoltaics





UNIVERSITY OF HOUSTON



# Solid-State Lighting & Printed Electronics



Thank you!  
Questions?

Special acknowledgements to Corning Inc., ITN Energy Systems, Lucintech, University of Houston, Holst Centre, Intellivation and Liquid X