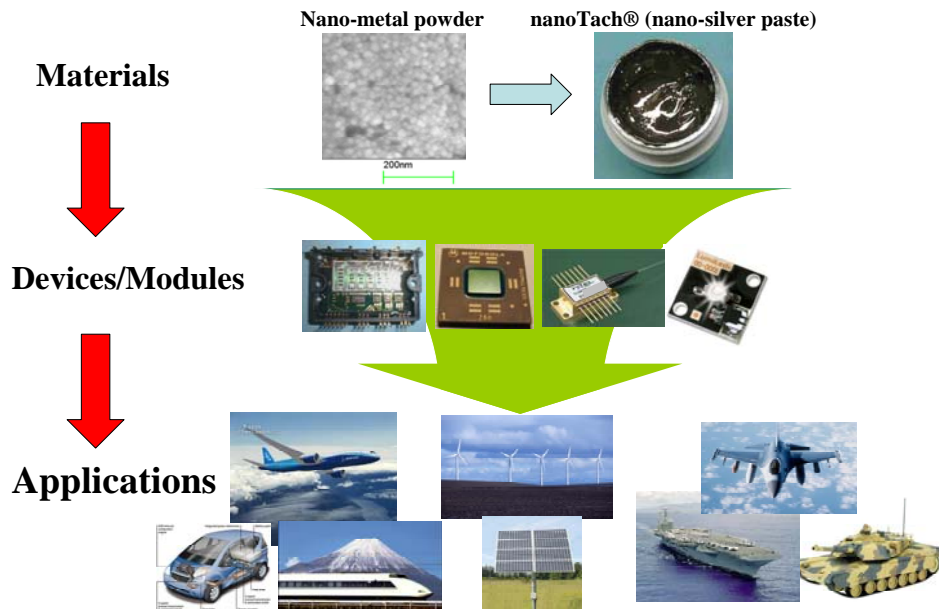
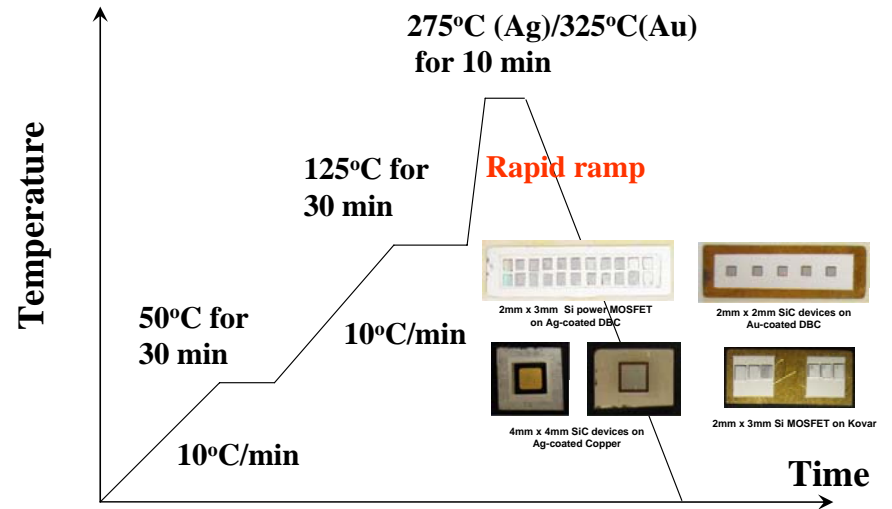


## Main features:

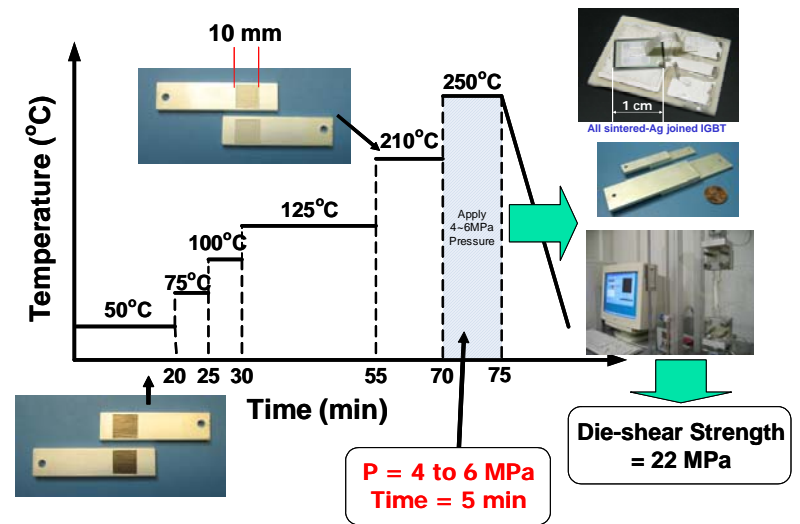
- ✓ One-to-one lead-free replacements for solders, epoxies, and thermal greases;
- ✓ Excellent (>5 times) electrical and thermal properties and high-temperature (> 250°C) capability;
- ✓ Low modulus for better reliability;
- ✓ Low-temperature, zero or low-pressure (< 6 MPa) processing for small to large-area attachments.



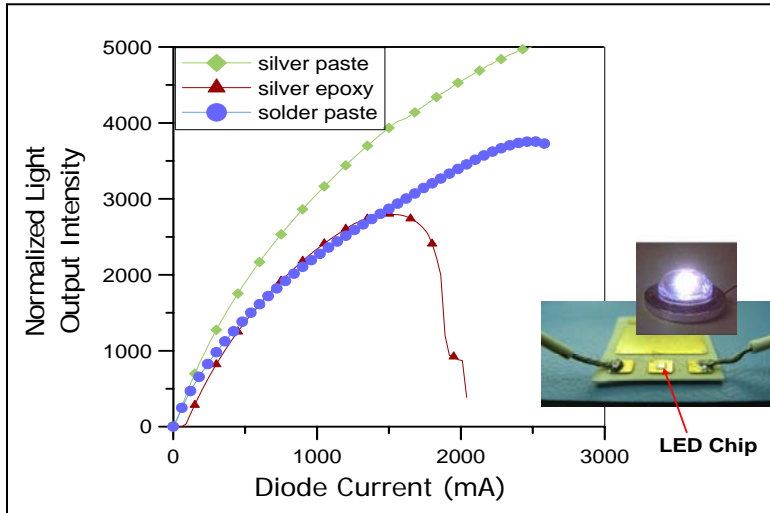
## Low-temp, zero pressure process for small-area bonding



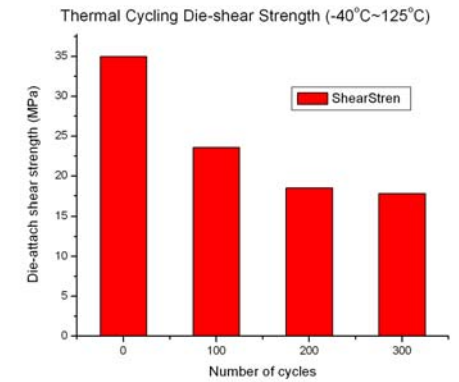
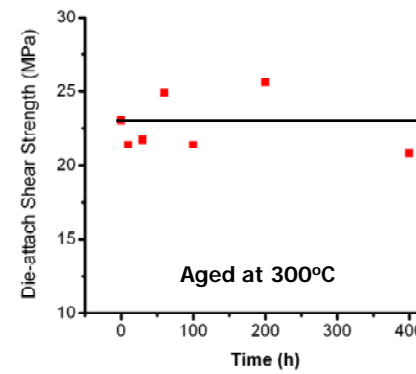
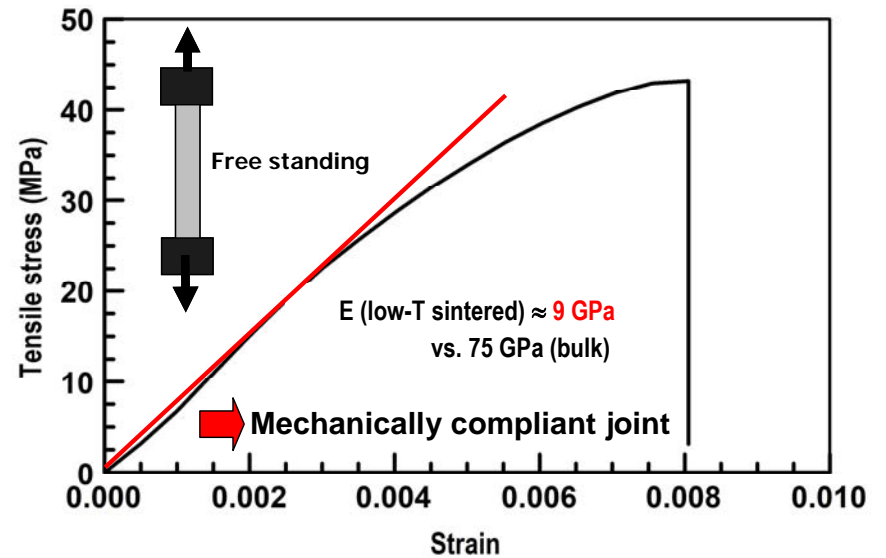
## Low-temp, low-pressure (< 6 MPa) process for large-area bonding



## Demonstration of superior thermal property



## Reliability of sintered joints



## NBE materials compared with other interconnect / interface materials

Feature Material	Processing temperature	Max. use temperature	Electrical conductivity $10^5 (\Omega\text{-cm})^{-1}$	Thermal conductivity (W/K-cm)	Die-shear Strength (MPa)	Price (\$/gm)
Lead-tin solder	217°C	< 183°C	0.69	0.51	35	< 1.0
Lead-free solder	260°C	< 225°C	0.75	0.70	35	< 1.0
Gold-tin solder	310°C	< 280°C	0.625	0.58	30 - 60	50 - 80
Silver epoxy	100 - 200°C	< 200°C	0.1	0.1	10 - 40	2 - 9
Sintered nano-Ag	< 300°C	< 961°C*	3.8	2.4	20 - 40	competitive

## Facility in place for mass production



VIRGINIA TECH  
 CORPORATE  
 RESEARCH CENTER