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National Institute for Nano Engineering

Micro-Nano Sensors & Actuators for Use in Extreme Environments and Process Control

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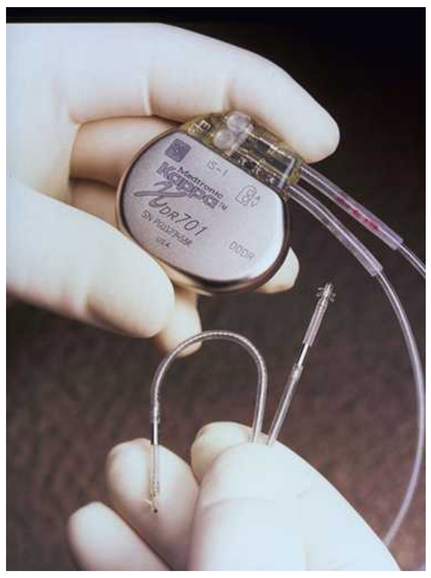
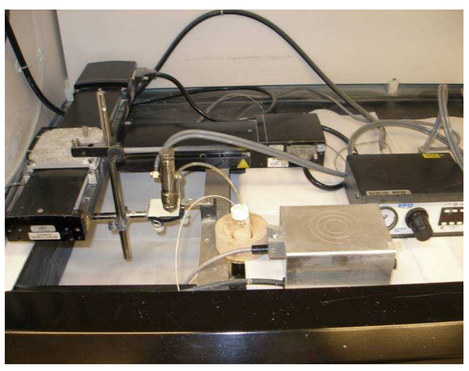
Needs

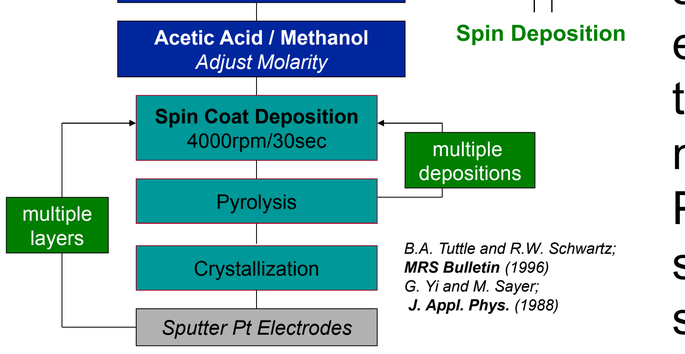


Robust high-operating-temperature (up to ~300°C) piezoelectric systems are needed for applications such as down-hole systems, implantable medical devices, autonomous sensors, and next-generation fuel injectors.

Fabrication

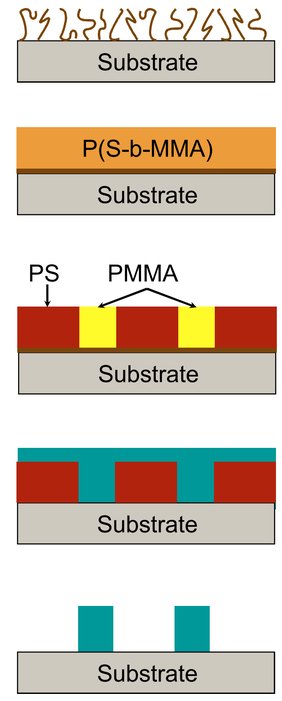
micro ⇒ nano

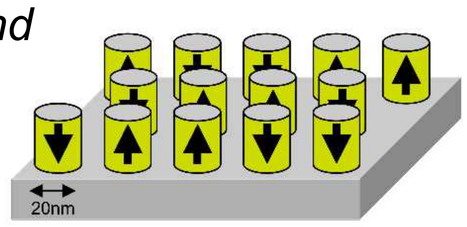


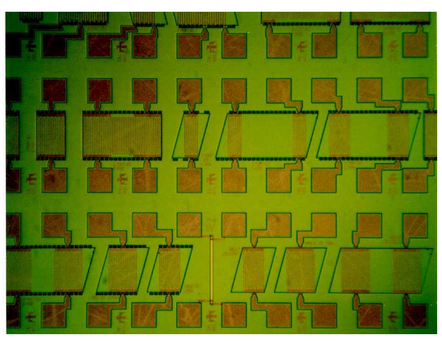


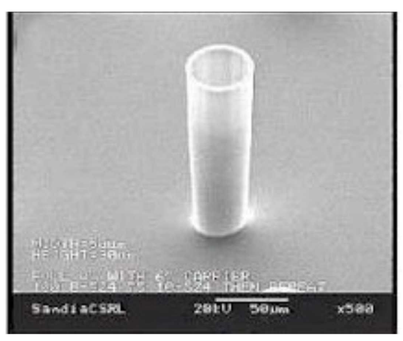
Aerosol spray deposition (above) is ideal for micro-scale fabrication using SNL-patented chemically-prepared nanopowders. Solution deposition (above right) can produce electrically functional continuous, even multilayer, or patterned films from 10 to 1000 nm (bottom center, right). Bilevel patterning extends local order across larger features.

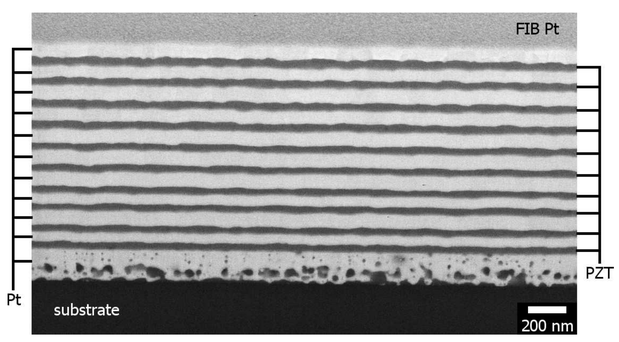
Self-assembled diblock copolymer masks enable the fabrication of discrete patterned nanofeatures for fundamental studies of interface and size effects on domain drift and long-term property stability in nanostructured materials. Proper control of the substrate surface allows us to pattern solution-derived materials on essentially any substrate. *(with Prof. John Ekerdt at the Univ. of Texas-Austin and Profs. Paul Nealey and Padma Gopalan at the Univ. of Wisconsin)*

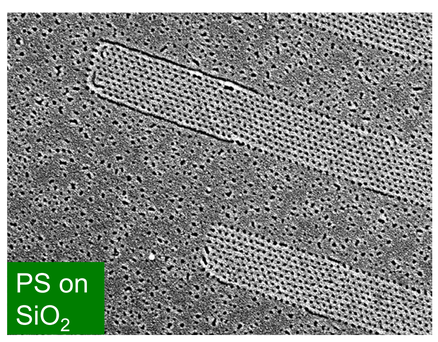


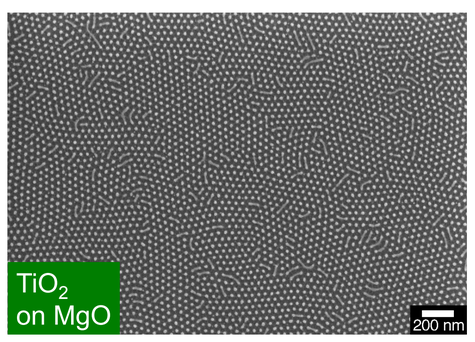








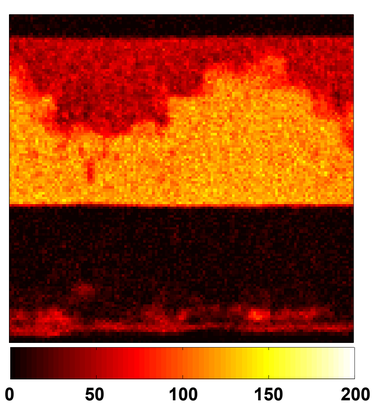


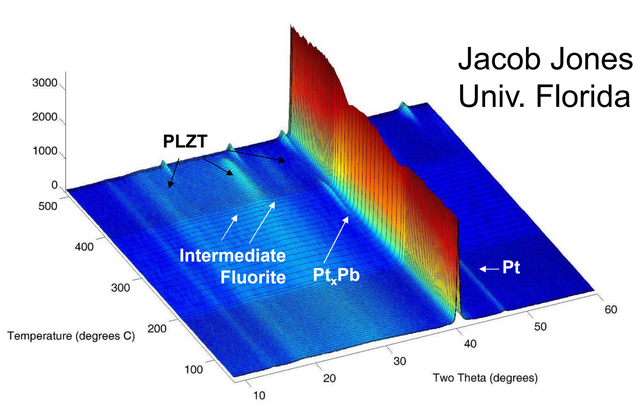


Micro- and nanofabrication capabilities at Sandia enable the functional integration of novel materials into actual devices.

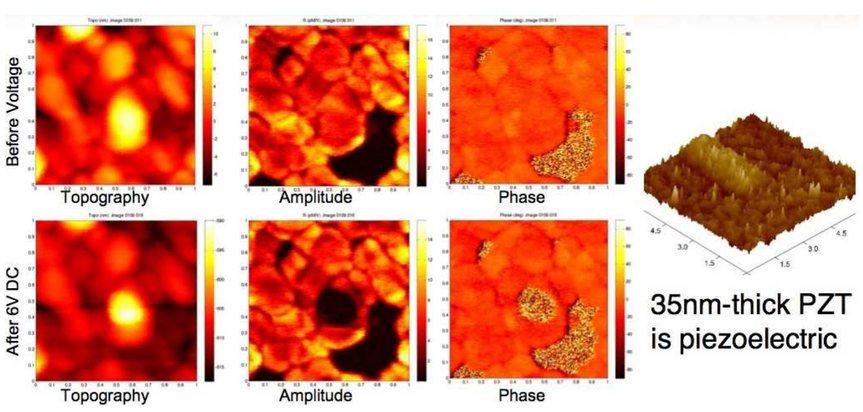
Characterization

Control of nanoscale phase/interface development and chemical segregation are critical for electrical performance.

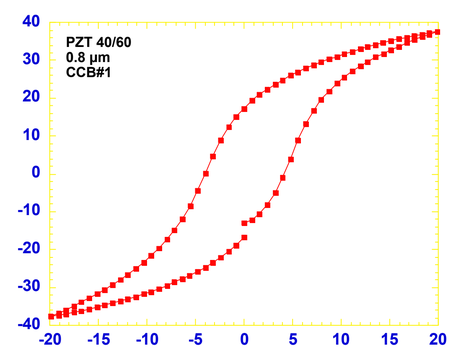




Jacob Jones
Univ. Florida



35nm-thick PZT is piezoelectric



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