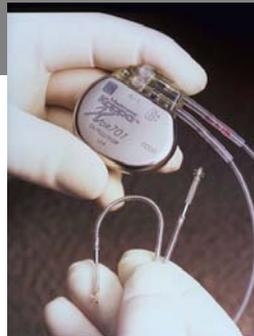


Micro-Nano Sensors & Actuators for Use in Extreme Environments and Process Control

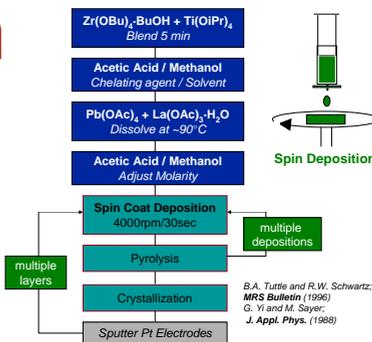
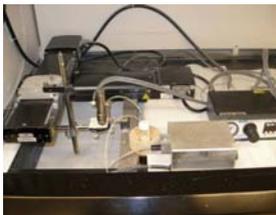
Bruce Tuttle, Geoff Brennecke, Chris Ablett, Joe Henfling and Paul Galambos Sandia National Laboratories
John Ekerdt University of Texas at Austin and Paul Nealey University of Wisconsin

Needs

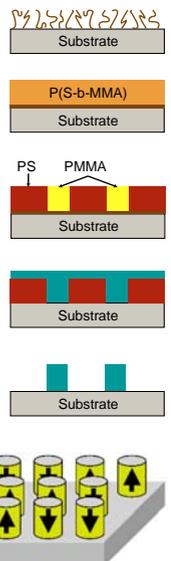


Robust high-operating-temperature (up to ~300°C) piezoelectric systems are needed for applications such as down-hole systems, implantable medical devices, autonomous sensors, and next-generation fuel injectors.

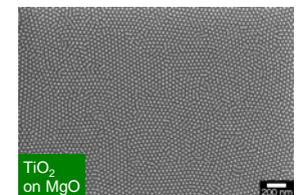
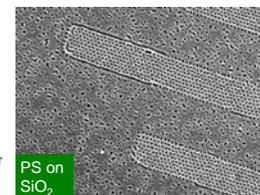
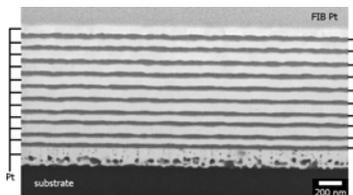
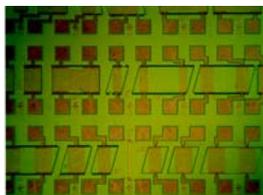
Fabrication micro ⇒ nano



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)



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.



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.

