

4. NUGGETS

4.1 CURRENT DISCOVERIES AT AND ACROSS THE FRONTIER OF SCIENCE AND ENGINEERING

4.1.1 TOWARDS LARGE-SCALE NANOPATTERNING OF OPTICALLY ACTIVE MATERIALS

S. K. Donthu, Z. Pan, G. S. Shekhawat, V. P. Dravid, "Near-field Scanning Optical Microscopy of ZnO Nanopatterns Fabricated by Micro-Molding in Capillaries (MIMIC)," submitted to *J. Appl. Phys.*

Large-area patterning of functional nanostructures is critical to translate advances in nanoscience to viable nanotechnology. This is particularly challenging for solid-state materials, such as functional oxides, where it is not only important to fabricate nanostructures with large aerial coverage, but also to validate their functionality at the nanoscale. An innovative approach has been developed called nano-molding in capillaries (NIMIC). This is the nanoscale version of micro-molding in capillaries (MIMIC). M/NIMIC relies on infiltration of a liquid precursor into a periodic array of capillaries, which is subsequently converted into an inorganic structure by thermal treatment. This is a versatile patterning approach with the flexibility to pattern a variety of materials across large areas, in excess of several centimeters.

A sol-gel precursor approach, developed by this group, has been combined with the NIMIC technique to pattern large-scale areas of ZnO nanostructures, and validate their optical characteristics using near-field scanning optical microscopy (NSOM). The ability to pattern optically active materials such as ZnO is critical to realize their potential in many technologies such as gas sensing and light-emitting devices. The successful large-scale nanopatterning of "functional" ZnO represents a significant step forward towards that goal.

