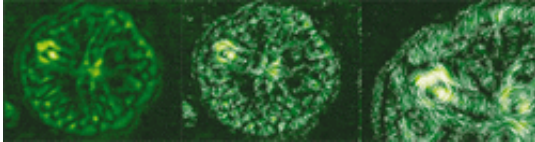


Lighting the Way to Better Nanoscale Films

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Most miniature electronic, optical and micromechanical devices are made from expensive [semiconductor](#) or ceramic materials. For some applications like diagnostic [lab-on-a-chip](#) devices, thin-film polymers may provide a cheaper alternative, but the structure and properties of these materials - often no more than a few nanometers (nm) thick - are difficult to determine. In addition, defects in the thin polymer masking materials used to "print" integrated circuits can produce malfunctioning components. Consequently, researchers would like to have **a non-invasive method for scanning polymer films for defects at high resolution.**

In the Aug. 23 issue of Applied Physics Letters,* researchers at the National Institute of Standards and Technology (NIST) report on an application of a new method for studying ultrathin polymers that makes it possible to visualize defects and structure in these materials and should help improve basic understanding of crystal formation in polymers.

Image: Left: The crystal structure of a thin-film polymer "seaweed" crystal

that is about four micrometers wide. Brighter areas indicate parts of the crystal with the greatest "strain." Center: The same crystal with lines superimposed showing the direction of strain between the crystal's atoms. Right: Closeup of the upper left portion of the center image.

Using a special form of near-field scanning optical microscopy, the NIST researchers were able to determine the structure of, and "strain" (stretching between atoms) in, thin-film crystals of polystyrene. Polystyrene is a ubiquitous plastic found in foam cups, CD cases and many other products.

The films examined formed tiny crystals just 15 nm thick and about 1500 nanometers wide, which makes them difficult to study with other optical microscopes. In the NIST experiments, blue-green light was piped through a glass fiber about 50 nm wide and scanned across the sample about 10 nm above the surface. Changes in the polarization of the light (the direction of the wave's electric field) as it transmits through the sample then were used to investigate the material's crystal structure and to map areas of strain.

The NIST results should help scientists choose and improve polymer materials and processes for fabricating a range of microscale and nanoscale plastic devices.

Source: NIST

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