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Single fluorophore localization and orientation reports structure and deformation at the nanoscale MUZHOU WANG, Northwestern University, JAMES M. MARR, MARCELO DAVANCO, JEFFREY W. GILMAN, J. ALEXANDER LIDDLE, National Institute of Standards and Technology — Super-resolution microscopy offers an exciting method to image nanostructures non-invasively, opening the possibility of direct in situ real-space observation at the nanoscale. Most previous studies have applied these techniques to important scientific problems in the biological community, but little work has explored their use in materials science, where important effects such as dye chemistry and fluorophore orientation introduce new demands. Here we apply photo-activated localization microscopy (PALM) to polymer films nanopatterned using electron-beam lithography. Our fluorophore localization precision and accuracy are less than 10 nm, and we are able to resolve features as small as 20 nm. In addition, we demonstrate that single fluorophore orientation can be determined from the shape of their in-focus images. Combined with localization, orientation offers an additional reporter of nanoscale environment within a material. This capability is demonstrated on polymer films that have been deformed through nanoimprint lithography, and the orientation provides information about local stress and damage experienced during the fabrication process.

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