Pushing the Limits of Near-Field Microscopy

Erik J. Sánchez
Portland State University
Portland, OR

Recent advances in aperture-less near-field microscopy allow unprecedented optical and spectroscopic resolution on the scale of 20 to 30nm. The key behind this technique is the probe geometry, incident light polarization orientation and type of illumination [two-photon excitation (TPE)]. Using 3D finite-difference time domain (FDTD) modeling of new tip shapes coupled with a dual beam focused ion beam (FIB), it has been possible to design tips with high electric field enhancement factors in order to achieve ultra-high resolution spectroscopic detail. This technique has been applied to fluorescence as well as Raman detection, and with this resolution we have imaged biological samples such as thylakoid membranes [extracted intact from spinach chloroplasts (Spinacia Oleracea)], polymers (J-aggregates of PICI dye), and, recently, single-walled nanotubes.