Near-Field Vibrational Spectroscopy and Imaging of Chemical Species on Nanoparticles during Catalytic (de)Hydrogenation

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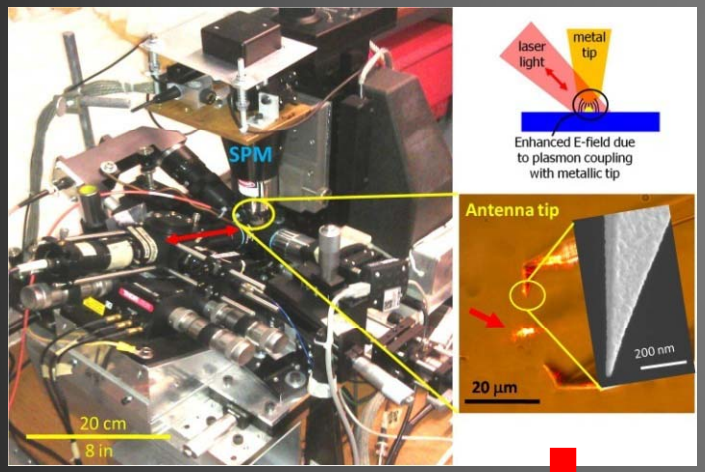
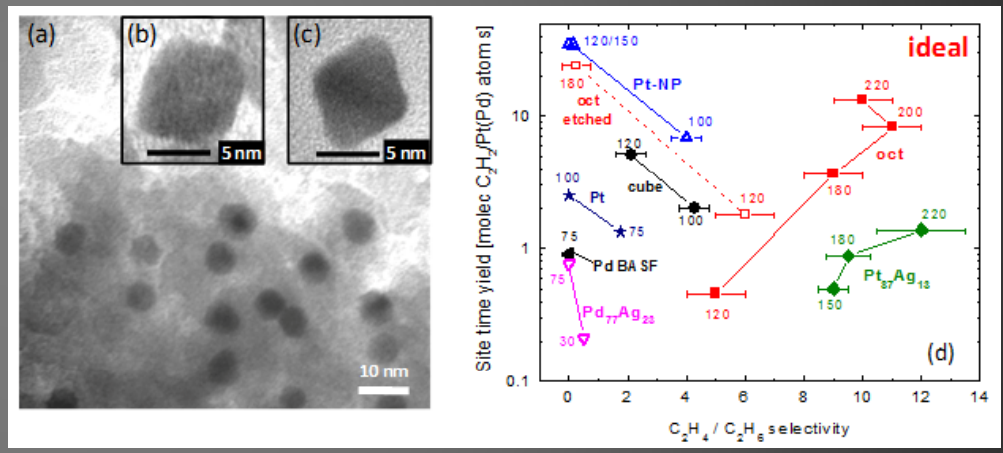
Interaction of laser light with free electrons in metallic nanostructures (also known as *plasmonics*) can be used to focus optical fields to dimensions far below the diffraction limit. These spatially-confined optical fields are used to excite and detect molecular vibrations of chemical species on a surface when a field-enhancing optical antenna or "tip" is brought in close proximity (few nm). Excitation of molecular bonds by the probe light results in Raman scattering [an inelastic process] which provide chemical information about the surface below the tip. In this work, we combine near-field vibrational spectroscopy with plasma and solution-based synthesis to investigate the morphology and surface chemistry of nanoscale catalytic materials.

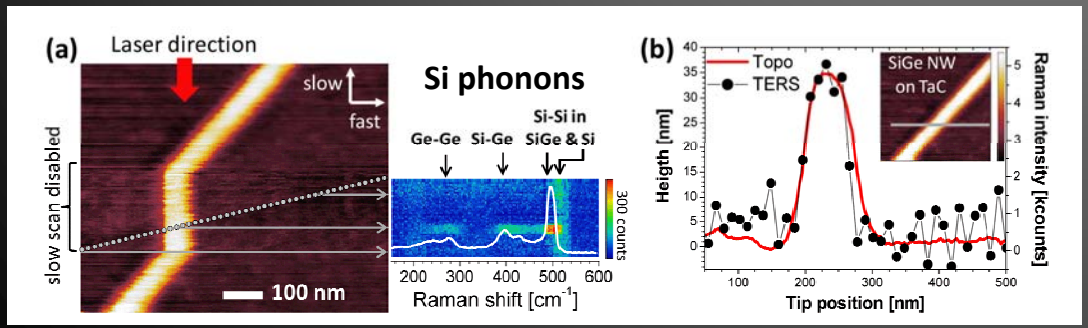
Custom-built atomic force and tip-enhanced, scanning near-field optical microscope



PtAg nanoparticle catalysts for selective C_2H_2 hydrogenation



All optical *chemical* imaging of surfaces at 6 nm spatial resolution



Microplasma synthesis of catalytic nanomaterials