Properties of nano-structured surfaces.

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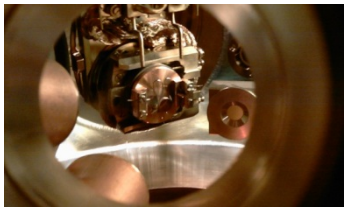

Properties of surfaces are important for technological applications in fields like corrosion, tribology, production of electronic components, and heterogeneous catalysis. Although metal nanoparticles possess many of the properties of single crystalline substrates from the same material, experiments have shown that a nanoparticle array contains new degrees of freedom due to concentration of defects and rapid reconstruction due to the many lower coordinated atoms. In addition, changes in electronic structure due to interaction to the support of the nanoparticle array are important. For example, it has been known for decades that metal nanoparticles in the range 2 to 10 nm that are dispersed on catalytically inactive oxide supports may have catalytic turnover rates of more than ten times that of a metallic substrate.

In our laboratory, metal nanostructures on various substrates are fabricated and investigated. The experimental toolbox includes XPS (X-ray photoelectron spectroscopy), UPS (ultraviolet photoelectron spectroscopy), LEED (low energy electron diffraction), TPD (temperature programmed desorption spectroscopy), and a range of sample preparation techniques.

Projects include:

- Adsorption and desorption of carbon dioxide on clay materials and oxide substrates. It has been shown that clay may adsorb substantial amounts of carbon di-oxide, which may be of considerable interest to problems related to the environment and climate change. The mechanisms by which carbon di-oxide is captured on doped surfaces will be investigated.

- Surface reactivity of doped ferroelectric surfaces. The polarity of ferroelectric substrates has an effect on adsorption properties and reactivity. Sub-monolayer amounts of different metals will be deposited onto $BaTiO_3$ substrates in which the polarity will be varied. Adsorption and desorption of simple gases like CO and CO_2 will be studied by photoemission and temperature programmed desorption.