SJSU | DEPARTMENT OF CHEMISTRY

CHEMISTRY Departmental Seminar

Fall 2017
CHEM 285 Schedule
Tuesdays at 4:30-5:45PM
Room Duncan Hall 250

November 7, 2017

Professor Abraham Wolcott
San José State University

Fundamental surface modification and synchrotron-based spectroscopy of nanoscale diamond with amines, boranes and silica

The Wolcott lab is interested in fundamental surface studies of diamond and other semiconductor materials and we use a myriad of techniques to complete our work. We conduct science at SJSU as well as Department of Energy user facilities, The Molecular Foundry at Lawrence Berkeley National Laboratory and the Stanford Synchrotron Radiation Lightsource. Today's talk will focus on our progress in fluorescent nanodiamond for next generation biological labeling.

The fluorescent nitrogen vacancy center in diamond is a powerful imaging tool of both magnetic and electric fields with nanometer spatial resolution. Tracking of individual NVCs hosted in nanoscale diamond is possible because of their electron-spin readout properties and opens new avenues for imaging in cells and tissues. Fluorescent nanoscale diamond (FND) is produced via ball-milling of macroscopic high-pressure high-temperature diamond and has electronic and surfaces properties that are nearly identical to bulk diamond. While FNDs are attractive for biolabelling due to their chemical inertness and lack of cytotoxicity, few chemical routes exist to modify their surface and most routes focus on carboxylate chemistry. Here we use gas phase and wet chemical techniques to modify the surface with amines, boranes and silica and provide definitive chemical analysis with surface sensitive spectroscopies. Our goal is to increase the chemical reactivity of the inert diamond surface and probe new routes for functionalization. We confirm the FND surface moieties using overlapping spectroscopies based on laboratory (FTIR) and synchrotron based techniques (X-ray absorption and X-ray photoelectron spectroscopies). Near surface covalent bond formation (inner shell chemistry) of tertiary amines, borates and silica are then used as molecular anchors for further functionalization with stabilizing and bioactive moieties. Previously we demonstrated the staining efficiency of FNDs by targeting live hippocampal neurons and found diffraction limited resolution of dendritic spines. Our work is promising for both the fundamental surface science of diamond surfaces and their applied use in biolabelling modalities based on the nitrogen vacancy center.

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