

Seminar Series

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School of Materials Science and Engineering

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5:00 PM – Room 200 Olin Hall

Synthesis and polymorphic control for visible light active TiO₂ nanoparticles

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Advisor: Burtrand I. Lee

Visible light active polymorphic titania samples were prepared by post-treatment of a water-based ambient condition sol (WACS) sample using a solvent-based ambient condition sol (SACS) process with N-methylpyrrolidone (NMP) as the solvent. SACS samples were calcined in air atmosphere at various temperatures for 2 hours. Nitrogen incorporation of SACS titania was investigated by CHN analysis and x-ray photoelectron spectroscopy (XPS). All samples were also characterized by x-ray diffraction, N₂ physisorption, UV-Vis absorption spectroscopy, FT-IR, and TEM and compared to a commercial titania powder, Degussa P25. The calcination temperature has an influence on the BET surface area, crystallite size, titania phase content, and photocatalytic activity, evaluated by the degradation of methyl orange dye under both UV and visible light (VL) irradiation. The SACS-NMP is an effective method to extract lattice hydroxyls and to decorate the titania surface with nitrogen. SACS-NMP calcined in air at 200°C for 2 hours showed the best visible light activated photocatalytic performance in this study.

Cantilever sensor based on a membrane grafted with an active nanothin coating

Oleksandr Burtovyy

Advisor: Dr. Igor Luzinov

The focus of this presentation is on response of a silicon cantilever carrying attached polymeric membrane to presence of various substances. Specifically, changes of membrane weight were monitored and correlated with environment. PET membranes with a pore size of 200 nm were used in the study. Surface of the membrane was modified with grafting of responsive ultrathin layers of polymer chains to enhance its sensitivity and selectivity. Reactive anchoring interface, necessary for the grafting, was created by deposition of several nanometers of poly(glycidyl methacrylate) on the membrane boundary. A 100x100 μm² piece of the modified membrane was attached to AFM cantilever and system was exposed to various solvents' vapors. Changes of cantilever's vibration frequency correlated with interaction between the membranes and the vapors. The technique allows us to monitor weight changes with accuracy of ~ 0.05 – 0.1 nanogram. Membranes modified with different grafted layers demonstrated unique response to solvent vapors. The membrane-based sensor can be used for detection and recognition of various compounds in gas phase.