

Title: Transition Metal Doped ZnO Semiconductor Nanoparticles: Synthesis and Characterization of Electronic Structure

Type: Student

Awardee: Nick Norberg

Mentors: Daniel Gamelin – UW; James Amonette - PNNL

Description: I propose to synthesize transition metal doped ZnO nanocrystals (TM:ZnO), often referred to as diluted magnetic semiconductors (DMS). Once synthesized, I will use absorption, luminescence, magnetic circular dichroism, and electron paramagnetic resonance spectroscopies to study these ZnO nanocrystals doped with Co, Mn, Fe or other transition metals. The combination of these spectroscopic techniques can help to provide a thorough picture of the electronic states, spin states, oxidation states, dopant geometries, and magnetic behaviors of these materials. By correlating the electronic structure with magnetic behavior of these materials, I will analyze the electronic exchange coupling between the semiconductors and the doped transition metal cations. These interactions are thought to induce ferromagnetism, making DMSs important materials for the development of spintronic technology. My focus will include determining optimum synthetic techniques for colloidal growth in solution of doped ZnO semiconductor nanocrystals with the aim of controlling size, uniformity, dopant concentration, and ultimately magnetism.