We report on two methods for depositing nanocrystalline semiconductor material into nanochannel glass (NCG) arrays. Both methods are general and should be applicable to a variety of semiconductors. The first method employs CVD techniques to deposit GaN into the nanochannel glass resulting in a periodic array of polycrystalline wires with high aspect ratios. The second method involves the deposition of soluble semiconductor nanocrystals such as CdSe and InP from solution into the NCG arrays. This method can allow for the control of the amount of material deposited into the arrays and we have made progress in obtaining a high fill fraction of nanocrystal material in the channels. The structures are characterized using optical and electron microscopies. These composite structures have the potential to exhibit interesting photonic band gap effects while the NCG also provides an excellent template for ordering quantum confined materials into a macroscopic array.

Near-field and confocal scanning spectroscopy/microscopy of porphyrin wheels

Scherning, et al. recently reported the preparation of a unique type of self-assembly, comprised of certain porphyrin compounds, and in the shape of a ring with a diameter in the micron range and a ring height and width on the order of tens of nanometers. These wheel-like molecular aggregates are related to ring-shaped molecular aggregates known to occur in nature, e.g., in the bacterial light-harvesting complex, LH2. This paper is concerned with a detailed microscopic investigation of porphyrin wheels by confocal visible-near-IR fluorescence microscopy and fluorescence scanning near-field optical microscopy and scanning force microscopy. These methods are used to study the spatially resolved fluorescence and absorption spectra, including measurements with polarized light and polarized detection. The results offer insight into several aspects of the structure and photophysical dynamics of the rings, the degree of molecular order and orientations.

Percolation threshold for exchange narrowing in sodium-doped sodium bromo sodalite

A solid solution of paramagnetic [(Na+)4(e')]x and diamagnetic [(Na+)4Br]1-x (0<x<1) clusters was synthesized in order to study percolation threshold for exchange interaction in sodalites. The x=0.05 stoichiometry produces a 13 peak EPR signal while the x=0.15 shows an additional narrow resonance (FWHM = 2G) that was previously attributed to metallic sodium clusters. Our studies show that the narrow resonance is due to exchange interaction among electrons associated with Na+3 clusters in neighboring sodalite cages. Highlights of power-dependent and temperature-dependent EPR studies will be presented.

Photoelectron spectroscopy of metallocarbohedrenes M8C12- (M=Ti, V, Cr, Zr, Nb)*

Photoelectron spectroscopy experiments have been performed on five metallocarbohedrene (met-car) anions, Ti8C12-, V8C12-, Cr8C12-, Zr8C12-, Nb8C12-. These met-car anions were produced by two different methods. We found that the Ti and Zr met-cars show unusually low electron affinities (EAs) and that the EAs increase from Ti to Cr met-cars. The observed photoelectron spectra and the electronic structure of the met-cars are interpreted using existing theoretical calculations.*This work is conducted at Pacific Northwest National Laboratory, operated by Battelle Memorial Institute for the DOE under Contract DE-AC06-76RLO1830.