CLUSTER FORMATION AND ANNEALING BEHAVIOR OF DOPED PARAHYDROGEN SOLIDS

C. MICHAEL LINDSAY and MARIO E. FAJARDO, *AFRL/MNME, Energetic Materials Branch, Ordnance Division, U. S. Air Force Research Laboratory, 2306 Perimeter Rd., Eglin AFB, FL 32542-5910*.

Infrared spectroscopy is used to study the dopant cluster formation and annealing behavior of doped solid parahydrogen. Parahydrogen matrices containing 10-1200 ppm of molecular dopants are produced using the Rapid Vapor Deposition technique and probed with a high-resolution absorption FTIR spectrometer. Samples deposited at 2.2 K are found to be composed of a mixture of face-center cubic (FCC) and hexagonal close-packed (HCP) lattice structures. Upon annealing at 4.5 K, an irreversible conversion from FCC to HCP structure occurs, dopant-dopant and orthohydrogen-dopant clusters are formed, and the local structure around each dopant becomes more homogeneous. Polarization spectroscopy of the impurities before and after annealing has revealed that there is a dramatic change in the macroscale homogeneity as well, with the apparent preferential alignment of the HCP crystallite c-axes with the substrate normal upon annealing. Spectra of HCN, CO, NO, and CH_4 over a range of concentrations will be presented and compared to the corresponding spectra obtained by other groups in the supersonic expansions and within superfluid helium droplets.