CO IN SOLID PARAHYDROGEN: A MOLECULAR THERMOMETER

MARIO E. FAJARDO and SIMON TAM, *AFRL/PRSP, Propulsion Sciences and Advanced Concepts Division, US Air Force Research Lab, Edwards AFB, CA 93524-7680..*

We utilize reversible temperature dependent changes in the infrared absorption spectrum of CO molecules in solid parahydrogen (pH2) to probe the temperature profiles of the matrices during deposition. The intensity of a well resolved absorption feature near 2135 cm-1 shows a monotonic increase with temperature over the 2 to 5 K range. The initial state of this transition is estimated to be 8 K above the ground state of CO/pH2. During the deposition of 100 PPM CO/pH2 samples, we detect temperature gradients of order 10 K/cm in samples subjected to estimated heat loads of a few milliwatts per square centimeter. The resulting estimated thermal conductivities range from 0.0001 to 0.001 W/cm-K, four orders of magnitude lower than the conductivity of single crystal solid pH2, and more than two orders of magnitude lower than previously measured for pH2 solids doped with 100 PPM concentrations of heavy impurities [a].

[a] V.G. Manzhelli, et al., Low Temp. Phys. v22, p131 (1996).