	Experiment title: Symmetry-resolved density of states of diamond	Experiment number: HE-2139
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Report:

We performed x-ray Raman scattering measurements at the carbon K-edge of diamond. Our aim was to measure the momentum transfer (q) dependence of the scattering spectra. The purpose of this study was to address failure of current state of the art theoretical schemes to reproduce the near edge features of the experimental K-edge spectra. The analysis of the momentum transfer dependence of the experimental spectra relies on a recently proposed theoretical scheme [1]. Our ultimate aim was to apply this scheme by utilizing the q -dependence of the experimental spectra and to extract the angular momentum projected density of unoccupied electronic states of diamond.

The experiments were carried out on ID16 using the eV-resolution backscattering spectrometer. An additional Si(440) channel cut monochromator was used to increase the energy resolution of the incident beam. Together with a Ge(880) analyzer crystal the total energy resolution was 0.7 eV at 12.4 keV. Polycrystalline diamond powder was used as a sample and all measurements were carried out at room temperature. The typical count rates at the K-edge were 50 - 200 cps depending on the momentum transfer.

We obtained very good quality data using three distinct momentum transfer values. As shown in Figure 1, the changes in the spectra are subtle, but easily observable within the obtained counting statistics. The extracted angular momentum projected density of states is displayed in Figure 2. We have also studied the sensitivity of the

extracted density of states to various experimental uncertainties such as the statistical accuracy and normalization of the experimental data. Additionally we measured the momentum transfer dependence of the diamond core exciton with a total energy resolution of 0.58 eV.

The quality of the experimental data and the obtained results are certainly adequate to merit a publication. The manuscript is currently under preparation.

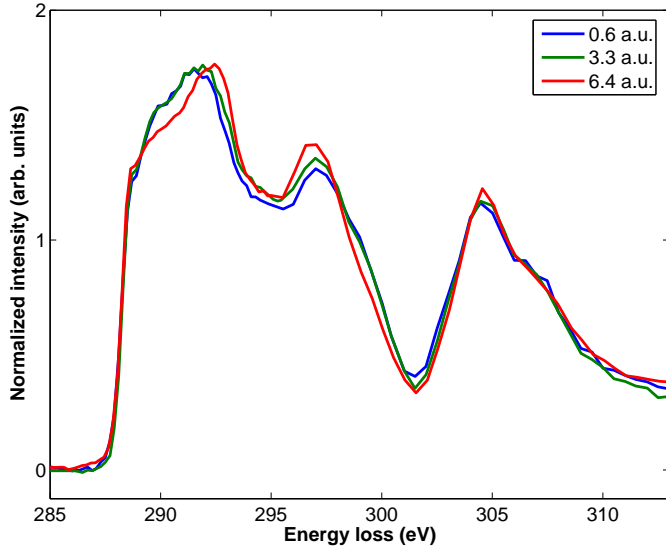


FIGURE 1: The momentum transfer dependence of the x-ray Raman scattering spectra of diamond near the carbon K-edge. The spectra are normalized to the same area.

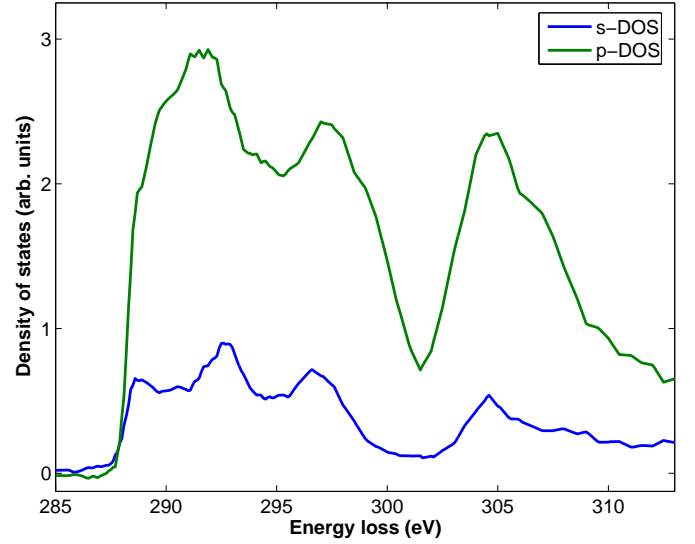


FIGURE 2: The symmetry projected density of states as extracted from the experimental data.

- [1] J. A. Soininen, A. Mattila, J. J. Rehr, S. Galambosi, K. Hämäläinen, J. Phys.: Condens. Matter **18**, 7327 (2006)