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Merging of Biological and electronics to remotely control

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Description

A study of the near-edge structure at the -edge of elemental boron in its -rhombohedral phase is presented. Momentum-transfer dependent measurements of the B 1s core-electron excitation spectra were performed by X-ray Raman scattering (XRS) spectroscopy. Spectral features were interpreted based on calculations of the XRS spectra. A method to model a system with Partially Occupied Sites (POS) was implemented based on FEFF simulations of XRS spectra. The inclusion of POS in the crystal structure of -rhombohedral boron in the calculations was essential in order to achieve agreement between simulated and measured spectra. Transitions from the core-level to exo-icosahedron orbitals were found to be sensitive to the presence of partially occupied sites in -rhombohedral boron. The origin and the momentum-transfer dependence of the spectral features are discussed. Characteristic spectral features from icosahedral units and from icosahedron clusters were identified. Activation of non-dipole transitions at high momentum transfers was detected.

Photoelectron Angular Distribution

The Photoelectron Angular Distribution (PAD) of the Kr 4 and 4 fine structure states was measured with linearly polarized synchrotron radiation in the vicinity of the resonant excitations of the 3 subshell. Experimental dipole and non-dipole anisotropy parameters were determined from the measured angular differential cross sections. In order to interpret our experimental results we have used a theoretical model going beyond the dipole approximation considering the quadrupole and octupole terms for the direct photoionization. We have taken into account several autoionization channels relevant for the studied photon energy range. The photon energy dependence of the measured anisotropy parameters puts in evidence the importance of the channel interactions. Moreover, unexpectedly large non-dipole contribution has been observed.

A method within the fully relativistic frame, based on the reconstructed Dirac–Coulomb Hamiltonian is suggested which applies to the plasma-embedded multi-electron atomic systems perturbed by applied magnetic fields. The proposal is a configuration interaction method and based upon a combination of two concepts, referred to as plasma screening and external magnetic field. An effective potential, derived by introducing a parameter dependent scaling of the radial dependence of free electron contribution in the ion-sphere, is adopted to model the interactions among the charged particles in dense plasmas, and also the range of external weak magnetic field B105 T is considered. In this instance, numerical calculations are performed for electronic structures and spectroscopic properties of the He atom and Fe ion as examples. The accuracy of the present approach is shown by comparison to previous theoretical calculations.

Ultrafast X-ray Photoelectron Diffraction

The behavior of energies of low excited states and radiative transition probabilities for allowed transitions as a function of the plasma screening and field strength is classified. These results are developed in high energy density physics and astrophysics context. We have performed the simulations of C 1 s X-ray photoelectron diffraction (XPD) profiles from C2H4I2, bridged and classical anti-forms of C2H4I intermediates and C2H4 products to capture structures of transient intermediates in the elimination reaction of C2H4I2, under our ultrafast X-ray photoelectron diffraction (UXPD) scheme for free molecules using soft X-ray free-electron laser (SXFEL). In the UXPD scheme, the sample molecules are aligned in advance by near-infrared (NIR) laser with ns pulse duration before applying a pump single bond probe method. Then, we have considered alignment control of C2H4I2 by using the elliptically polarized NIR laser to realize the UXPD experiments for the free molecules. As the results of simulations of XPD profiles from the laser-aligned C2H4I2 molecules, we have demonstrated the two-dimensional (2D) color maps of the C 1 s XPD profiles from C2H4I2, C2H4I, and C2H4. The 2D color maps have revealed that the transient C 1 s XPD profiles from the bridged-form and classical anti-form C2H4I intermediates exhibit remarkable differences, reflecting different intra-molecular scattering pathways of C 1 s photoelectrons within the intermediates. Thus, the present result has proved that UXPD for the free molecules has an advantage, compared with other traditional diffraction methods.

Oscillator strengths and cross sections of the valence-shell excitations in CF4 are of crucial importance in modeling the etching plasma and monitoring the greenhouse effect. In this work, generalized oscillator strengths of the valence-shell excitations in CF4 were measured by using an angle-resolved electron energy loss spectrometer, operating at incident electron energy of 1.5 keV and a high energy resolution of 80 meV. The experimental GOSs are analytically fitted with the well-known Lassettre formula, and, thus, the optical oscillator strengths are determined at the limit of squared momentum transfer. The analytical GOS also enables integration over, determining the Born cross sections with respect to the incident electron energy from the excitation threshold to 5000 eV. The BE-scaled integral cross sections for dipole-allowed transitions are obtained by adopting the BE-scaling method. Oscillator strengths and cross sections of the valence-shell excitations in CF4 provide an independent cross-check to the previous experimental and theoretical works. Moreover, the cross-checked data supplement and benchmark the molecular database for use in plasma models.

We report on the measurement of absolute cross sections and angular distribution of electron emission in the K-LL Auger region, upon electron impact ionization of molecular (CH and N) and atomic (Ne) targets. Differential cross sections in the K-LL Auger energy range were measured at 6 keV and 8 keV impact energies. The angular distribution of the K-LL Auger yield is shown to be isotropic for all the three targets. Total K-LL Auger emission cross sections were estimated by integrating the measured differential cross sections over the entire energy and angular range. The estimated cross sections are in good agreement with the theoretical estimates.