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**Report:**

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**Abstract:**
X-ray Raman scattering (XRS) provides a bulk-sensitive method of measuring the extended X-ray absorption fine structure (EXAFS) of soft X-ray absorption edges. Accurate measurements and data analysis procedures for the determination of XRS-EXAFS of polycrystalline diamond are described. The contributions of various angular-momentum components beyond the dipole limit to the atomic background and the EXAFS oscillations are incorporated using selfconsistent real-space multiple-scattering calculations. The properly extracted XRS-EXAFS oscillations are in good agreement with calculations and earlier soft X-ray EXAFS results. It is shown, however, that under certain conditions multiple-scattering contributions to XRS-EXAFS deviate from those in standard EXAFS, leading to noticeable changes in the real-space signal at higher momentum transfers owing to non-dipole contributions. These results pave the way for the accurate application of XRS-EXAFS to previously inaccessible light-element systems.