BL5B

Evaluation of higher order light of the PGM at BL5B

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We have measured the absolute efficiency of the desorption of rare gas atoms from the surface of solid rare gas layers by the irradiation of synchrotron radiation. Since the desorption yield depends on the energy of incident photon, the efficiency changes with the contribution of higher order light. Then, the higher order distribution of the output light of the monochromator (PGM) of BL5B was analyzed by using the second monochromator that measures the wavelength distribution of the output of the PGM. The wavelength range of the measurement corresponds to those energies effective to activate the desorption of excited and ground state neutral atoms of rare gases; 25 ～ 150 nm with the combination of grating and M2 mirror: G3M4. The second monochromator consists of a 5-axis goniometer, a transmission grating and a detector. The transmission grating manufactured by Shimadzu Co. has 1200 lines/mm. The detector is an electron multiplier with a BeCu photocathode (Hamamatsu).

An example of the angular distribution of beam diffracted by the transmission grating is shown in Fig.1. The peak positions change along with the equation: $d\sin\theta = n\lambda$, where d is a line spacing of the grating, θ is diffraction angle, n is an order of diffraction, and λ is the wavelength. Broken curves show the change of the position of the first order diffraction peaks of the original wavelength, and dashed curves show those of the first order diffraction peaks of the second order light (i.e. half of the original wavelength). Higher order contribution obviously increases with the wavelength.

Since the diffraction angles of the first order diffraction ($n = 1$) of original wavelength (λ) and the second order diffraction ($n = 2$) of the second order light ($\lambda/2$) coincide, theoretical diffraction efficiency of a transmission grating is used to determine the second order contribution. The relative photon number for each order light is calculated from the measured intensity taking into account the quantum efficiency of the detector (Fig.2.). Since the efficiency becomes higher when incident photon energy increases, the intensities of higher order in Fig.1. are too emphasized. The higher order lights are negligible for shorter wavelength region, however, they become comparable with the first order at wavelengths longer than 70 nm. These data are utilized to obtain the absolute desorption yield of rare gases.

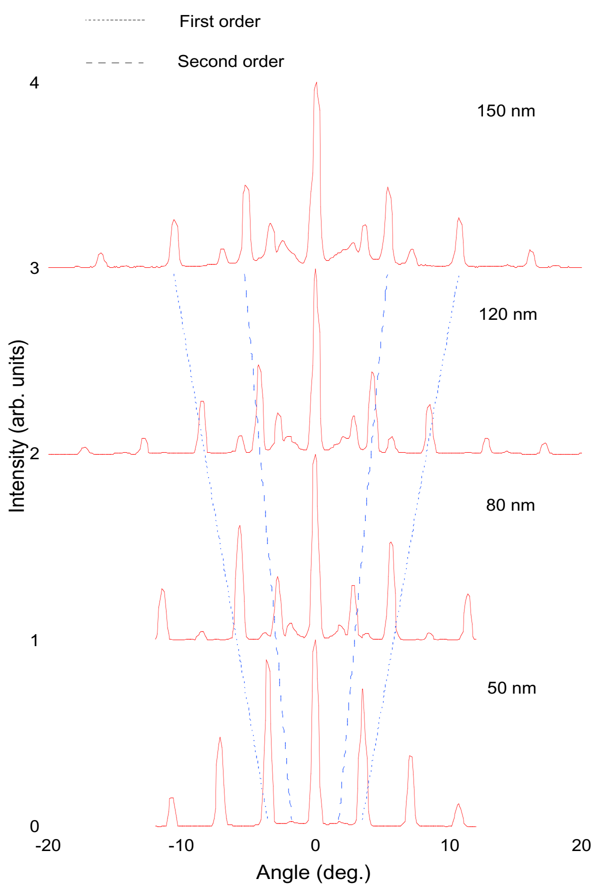

Fig.1 Angular distributions of the diffracted beam for various incident photon wavelengths.

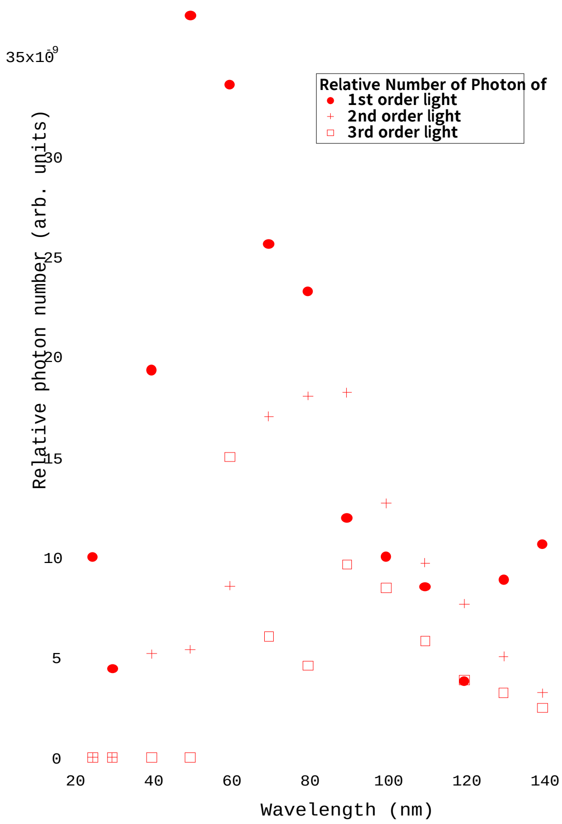

Fig.2 Relative photon number for each order light at various wavelengths.