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Polarization characteristics of silicon photodiodes and its dependence on oxide thickness in the far UV region

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Knowledge of the polarization characteristics of detectors is important for precise measurement when detectors are used at oblique incidence or when the incident radiation has a large divergence. However, little work has been done on this problem, especially in the far UV region. We have measured the response of silicon photodiodes with different oxide thicknesses for s- and p-polarized radiation, and compared these measurements to model calculations.

Experiments were performed at Beamline 4 of SURF II, which consisted of prefocusing mirrors and a McPherson type 2m normal incidence monochromator. We investigated two types of silicon photodiodes with different oxide thicknesses, 8 and 27 nm. The angle of incidence was typically set at 45°. Calculations were made using the complex refractive indices of the constituent materials based on an optical model in which the photodiode was assumed to be optically equivalent to a parallel silicon-dioxide (glass) layer on a silicon substrate.

We have found that there exists prominent structures in the polarization properties of silicon photodiodes in the wave-length range from 50 to 400 nm which depend significantly on wavelength.