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X-ray Reflectivity and Power Spectral Density of Smoothly Polished Silicon[1] LAHSEN ASSOUFID, ALBERT MACRANDER, SURESH NARAYANAN, RUBEN KHACHATRYAN, Argonne, SUNIL SINHA, UCSD —
Silicon polished by means of chemical-mechanical-polishing has been studied. A finely crevaced top surface was seen in the AFM data. The power-spectral-density was measured by means of interferometry and by atomic force microscopy, and a roughness value of 0.21- 0.23 nm rms was found by integration. X-ray reflectivity data for 10 keV x-rays were obtained at the Advanced Photon Source, and a roughness of 0.22 - 0.30 nm was found to be roughly consistent with these data. A surface layer with a slightly higher density than that of crystalline silicon was needed to model the x-ray reflectivity. Crevaces 3.6 nm deep and resulting in land areas having 85% coverage were invoked for the modeling. A total layer thickness of 7.4 nm was invoked for the modeling . That is, the crevaces penetrated roughly half way through the total layer thickness. Due to the overall agreement between the two very different techniques for measuring roughness, namely, PSD and x-ray reflectivity data, we consider these results to accurately quantify roughnesses for a silicon surface that is near the state-of-art for smoothness.

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