Measurements of Multilayers on a Ni Electroformed Mirror

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Since our last submission we have significantly improved the process of placing multilayers on the inside of a cylindrical mirror and have produced two truncated cones from a relatively high -uality mandrel (~0.5–0.6 nm surface prior to CN_x coating) manufactured by Hyperfine Inc. (Boulder, CO). A picture of one of these W/Si-multilayer-coated mirrors is shown in Fig. 1.

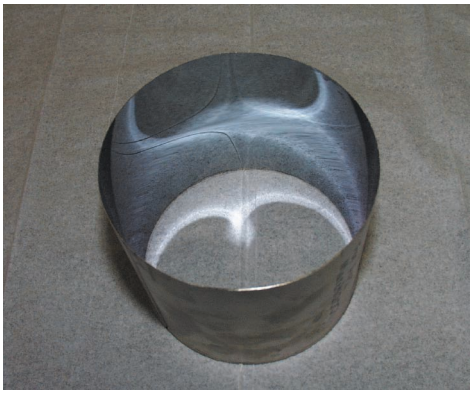

FIG. 1. W/Si multilayer coated mirror made by the IEMP process.

At the DND-CAT 5-BM beamline, we measured reflectivity at 30 and 40 keV. The results of the 40 keV measurements are shown in Fig. 5. Unfortunately, the tow-theta arm with detector mounted had too much flexure so the configuration did not allow us to make reliable measurements beyond 0.12º grazing angle. An independent measurement on a piece cut from a mirror was made at 8 keV and showed a multilayer peak at about 0.9º grazing angle. This corresponds to a 5.2 nm d-spacing and would show a peak at 0.18º for 40 keV. The ~10% reflectivity shown in Fig. 2 (bottom scale for theta is not visible; large tic marks are in steps of 0.01º and go from 0.02 to 0.1º; the plot ends at 0.12 degrees) is due to interference between the 60 layers of 5.2 nm d-spacing (W/Si layers) and represents a 2 order of magnitude improvement over results from a year ago. It compares very favorably with the 6% single bounce reflectivity at 8 kev reported by the Italian group for a similarly-manufactured Ni/C multilayer-coated Wolter I mirror .[1] We plan to repeat these reflectivity measurements at SRI-CAT and produce other mirrors using an existing Zeiss mandrel that has lower surface roughness than the Hyperfine mandrel.

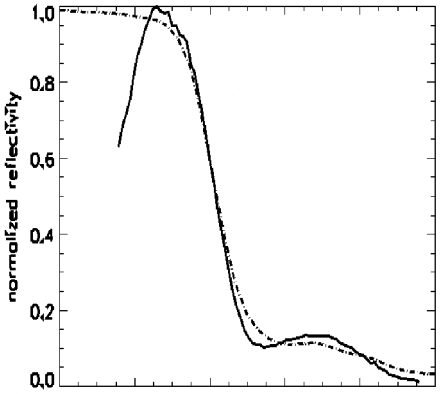

FIG. 2. Measured (-) and simulated (...) XRD reflectivity at 40 keV from the mirror shown in Fig. 1. The measurements were done at the DND-CAT bending magnet beamline. The simulations were done using the IMD program developed by D. Windt.

References

[1] G. Pareschi, O. Citterio, M. Ghigo, F. Mazzoleni, A. Mengali, and C. Misiano, *X-Ray Optics, Instruments, and Missions III*, Proc. SPIE Vol. **4012**, J. E. Truemper; B. Aschenbach, eds., p. 284-293 (2000).