“Nano-Fabricated” X-Ray Optics

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When hard x-ray focusing optics require segmented bending, the focal spot can be minimized by matching segment size to the synchrotron source size and focal ratio. At modern sources this implies features etched or cut into silicon on the 100 micron scale.

We describe our experience using photolithography and high aspect ratio reactive ion etching (RIE) to produce sagittal focusing crystals. The work was carried out at the Cornell Nanofabrication Facility.

RIE has been of great utility for the manufacture of micro-electromechanical systems (MEMS) which contain features typically a few microns in size. We have learned that because of the very large dielectric constant of silicon, a number of important considerations must go into a successful design when features are scaled up for x-ray optics applications.

Never the less, we have designed, built and tested x-ray optical devices produced using MEMS techniques, and in fact they are in regular use at CHESS. We describe our results from the point of view of mechanical robustness and focus quality, and offer general guidelines for future designers.

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