

**The fabrication of Wolter I multilayer coated optics via
electroforming: an update**

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Previously we reported the ability to lift off, via electroforming, multilayers deposited on gold coated flat mandrels. We had shown the multilayers remained intact after separation as the X-ray reflectivity produced peaks in the reflectivity versus energy measurements. Since gold is high a Z material and is not easy to remove via chemical etching, we have now developed the ability to use a low-Z material that is also etchable. Moreover, we improved the quality of the smoothing with the process of amorphous carbon nitride (CN_x) deposition on electroless nickel in both our test chamber and our much larger fabrication chamber. Our method of mandrel preparation is to first deposit CN_x on electroless nickel, then a low-Z release layer, and then the multilayers. We have demonstrated that flat mandrels produced in this manner can be cooled to liquid nitrogen temperatures without harm. This is important as the usual practice is to shrink mandrels that have Wolter I shape via liquid nitrogen. We have coated a truncated-cone-shaped ``engineering'' (not high quality in terms of smoothness) mandrel and have removed the layers, intact, on the inside of an electroform with a cylindrical, truncated-cone geometry. We report the details of the fabrication, engineering, and X-ray tests.