

A Multilayer Nanostructure for Linear Zone-Plate Applications*

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We have prepared a multilayer nanostructure of 728 layers with thicknesses gradually increasing from 10 to ~58 nm according to the Fresnel zone formula, for a total thickness of 12.43 μm . The thickness difference between the neighboring layers varies monotonically from 0.0067 nm at the thin end to 1.2421 nm at the thick end. We have grown this nanostructure on Si(100) substrates using dc magnetron sputtering of WSi_2 and Si targets with the power supplies controlled in the constant current, as well as the constant power modes. The multilayers were subsequently sectioned and polished for hard x-ray nanofocusing experiments. For x-rays diffracted by each and every layer to add “in phase” at the primary focus, the layers need to be deposited precisely with the correct thicknesses. Layer thicknesses were checked with SEM images on zone-plate multilayers and x-ray reflectivity measurements on test uniform multilayers. The challenges and experiments for the growth of this type of thick depth-graded multilayers with high accuracy of layer positioning will be presented.

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