

Surface analysis for better x-ray focusing

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Rigaku Innovative Technologies (RIT) produces x-ray optics based on multilayer mirrors. We deposit a multilayer mirror on a wafer and mount it on a solid backing in an elliptical shape to focus x-rays. The wafer surface imperfections, defects from the multilayer deposition, and figure errors induced by the mounting process result in some focal spot widening for the final optics.

We have used an AFM and a “ZYGO” interferometric microscope to study these imperfections determining the influence of each technological step on the focal spot quality. By analyzing substrates with AFM, we have seen that some substrates show dramatic difference between 1 x 1 micron and 20 x 20 micron field of view, while others show no difference. By analyzing power spectral density, we have observed a smoothing effect of a multilayer coating at spatial periods less than one micron as well as defects in multilayer coatings. We have seen machining marks on the surface of wafers from ZYGO microscope pictures. We also have done ray-tracing simulations based on the ZYGO data to see how the focal spot shape changes due to the surface errors. We will describe these and some other results in our presentation.

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