Thickness control for large area Mo/Si multilayers

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In extreme ultraviolet (EUV) range, solar emission lines at wavelengths of □=17.1nm (Fe-IX), □=19.5nm (Fe-XII), □=28.4nm (Fe-XV) and □=30.4nm (He-II) can be selected for imaging of solar corona. The development of multilayer technology has enabled the construction of new instrumentation and led to some successful missions including SOHO/EIT and TRACE. The nanometer layer accurate deposition and uniformity is one of the major challengers for multilayer mirror. In this report, the Mo/Si multilayer mirror with the size of 230mm was studied for near normal incident at wavelength of 19.5nm (Fe-XII) in China. The Mo/Si multilayer was deposited on a fused silicon substrate with a diameter (□) of 230mm and curvature radium of 2500mm by using direct current magnetron sputtering method. For this larger size of substrate, the thickness uniformity of the multilayer needs to controlled with special efforts. We used a scanning deposition mode. The fast spinning substrate moves over the sputter cathode with the size of 127mm×381mm. During depositing, the substrate was moving continuously over the targets. In order to optimize the lateral thickness uniformity, the substrate is spun at the high speed of 200r/min during depositing. The layer thickness was controlled by changing the revolution speed of the substrate when moving through the sputtering region. The uniformity of lateral layer thickness distribution was measured by X-ray diffractometer. The variation of the period thickness is within ±0.3% in □200mm (Fig. 1). The mean peak reflectivity is (42±2)% at 19.5nm, measured at National Synchrotron Radiation Lab in China (Fig. 2). The measured results show that this Mo/Si multilayer coating on larger size substrate has a good uniformity and high reflectivity.

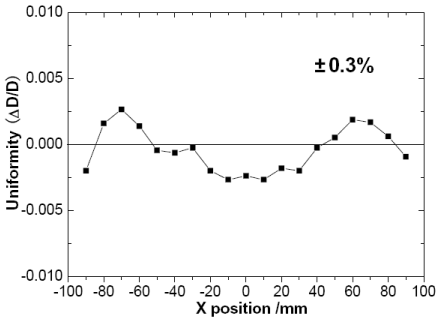

Fig. 1. Normalization lateral layer thickness distribution along the diameter of 200mm

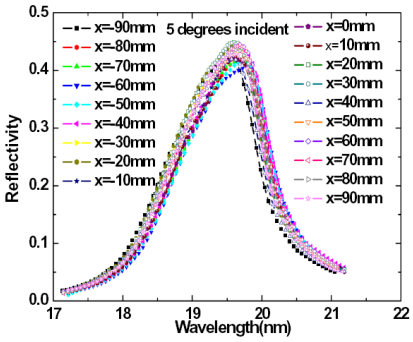

Fig. 2. The reflectivity curves measured on beamline U26 at NSRL

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