Reflectivity enhancement of multilayer neutron mirrors by ion polishing in combination with sputter deposition

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ABSTRACT

We have investigated the effect of argon ion polishing on the morphology and interface roughness of nickel/titanium and nickel/manganese multilayer neutron mirrors deposited by ion beam sputtering.

Recently ion polishing (also called as ion bombardment) in combination with electron beam deposition has been shown to be a promising method to reduce the interface roughness of multilayer X-ray mirrors. On the other hand, other combination of sputter deposition and ion polishing is desirable to decrease the interface roughness with marked improvement. Because sputter deposition has an advantage that the sputtered atoms arrive with higher energy than e-beam evaporation and it could produce good quality layers with higher density and small grain size.

We have applied ion polishing in combination with ion beam sputtering deposition for Ni/Ti and Ni/Mn multilayers. The ion beam polishing was applied immediately after the deposition of each layer to smoothen the surface of layer. The dependencies of ion polishing time, ion acceleration energy and incidence angle on the interface roughness were studied to optimize the conditions of Ar^+ ion polishing by using X-ray and neutron reflectometry. TEM observation was conducted on these multilayers. It was observed that the reflectivities and the evaluated interface roughnesses of Ni/Ti and Ni/Mn multilayers were obviously improved by using ion polishing.

Reference

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