Optimization of the ion-polishing process for e-beam produced Co/C and Ni/C mirrors with periods of 2.4, 3.9 and 6.5 nm.

E. Louis[1], H.-J.Voorma[1], N.B. Koster[1], F. Bijkerk[1], E. Spiller[2], S. Abdali[3], F.E. Christensen[3], A. Hussain[3].

[1] FOM-Institute for Plasma Physics Rijnhuizen, Edisonbaan 14, P.O. Box 1207, 3430 BE Nieuwegein, The Netherlands, tel. 31-30 6096999, fax 31-30 6031204, e-mail: louis@rijnh.nl

[2] Physics Institute of the Technical University of Denmark, building 307, 2800 Lyngby, Denmark.
Present adress: 60 Lakeside Road, Mt. Kisco, NY 10549. e-mail: Spiller@watson.ibm.com

[3] Danish Space Research Institute, Gl. Lundtoftevej 7, 2800 Lyngby, Denmark, e-mail: salim@dsri.dk

We produced multilayer coatings on a panel of flat super-polished Si(111) crystals to be used in a spectrometer at the spectrum röntgen-gamma satellite. We optimized the e-beam deposition parameters and ion-polishing process for Co/C and Ni/C coatings. For the optimization we monitored the soft x-ray reflectivity during production and we determined the interface roughness with grazing incidence reflectivity of 0.154 nm radiation.
The coatings developed for the satellite mission have a period of 3.9 nm. The effect of ion-polishing with Kr^{+}- and Ar^{+}-ions of energies ranging between 300 eV and 1000 eV incident at an angle of 20 degrees to the mirror surface will be discussed. We investigated the interface roughness as a function of the thickness removed by ion-polishing. To study the implantation of the ions in the layers we performed XRF-analysis.
The parameters that are found to be most effective for the reduction of the interface roughness were used as a starting point for the production of coatings with a much shorter period (2.4 nm). These coatings are made on very curved substrates (radius of curvature 50 mm) and are to be used as focusing elements in an X-ray photo-ionization experiment. The dependence of the optimum polishing parameters on the layer thicknesses will be discussed and reflectivity data of the coatings will be presented.
Furthermore we tested the applicability of the process developed to coatings with a period of 6.5 nm. Grazing incidence reflectivity measurements on these coatings will be presented.