Status of the Coating Activities at the Magnetron Sputtering Facility

M.C. Bellachioma, J. Cavaco, Ch. Kolligs, A.Krämer, and J.Kurdal
GSI, Darmstadt, Germany

Vacuum upgrade of the Heavy Ion Synchrotron SIS18

The production of thin film coatings by means of magnetron sputtering facilities has been started at GSI in 2005, in the context of the technical developments for the construction of the Facility for Antiproton and Ion Research (FAIR). In fact, to improve the beam lifetime and the beam intensity of the existing heavy ion synchrotron (SIS 18) an intensive programme for the vacuum upgrade was undertaken and among the different measures the installation of non-evaporable getter (NEG) coated pipes was considered. The production of the thin film getter was carried out in two cylindrical magnetron sputtering facilities described in details in Ref.[1], and the thin film characterization was performed by means of different techniques carried out at GSI, in CERN, and at the Magdeburg University [2, 1].
During the upgrade shutdowns from 2006 to 2009 24 dipole magnet chambers, 11 long collimator chambers and 5 straight vacuum chambers were replaced by NEG coated UHV chambers, which corresponds to app. 65% of the SIS18 circumference. The commissioning of the upgraded UHV system has been performed at the beginning of 2010 [3]: the acceleration and extraction of 2x10 $^{10}U^{28+}$ ions, which represents an intensity increase by a factor 100, was realized. In addition the achievable U^{28+} beam lifetime (t) was strongly improved, from $t < 1s$ before the UHV upgrade, reaching about $t = 11s$ after. During the measurements no increase of pressure was observed [3].

Collaboration with International Institutes

The experience acquired in the last years in the field of thin film coatings allowed the vacuum laboratory to carry out coating also for other Institutes. Starting from 2011 in collaboration with the company *FRIATEC AG*, for example, 6 ceramic chambers, elliptically shaped, were sputtered with a thin titanium layer to produce a required resistivity for **NSLS-II** (BNL). The collaboration, which resulted to be successfully, will proceed until the end of the current year.
Additionally, collaboration with the University of Heidelberg, the University of Princeton, and Hamburg were established in the last year, beside the support on the thin film production provided to the GSI groups.

Thin film coatings for FAIR

In the frame of the FAIR accelerator complex, the use of non-evaporable getter film is still under study. One of the possible application is on the dipole magnet chambers of the High Energy Storage Ring (HESR). The HESR, which will be completely realized by the Forschungszentrum Jülich (FZJ) is dedicated to strong interaction studies with antiprotons in the momentum range between $1,5$ and $15\ GeV/c$ [4].
The HESR dipole chambers, made by stainless steel, are more than 4 meters long, have a circular cross section of 89mm, and are characterised by a $8,2^o$ bending angle. For an easier integration of the dipole chambers into the sputtering system, a horizontal configuration of the facility is foreseen, and a design modification of the existing magnetron sputtering system is already ongoing, as shwon in Figure 1.

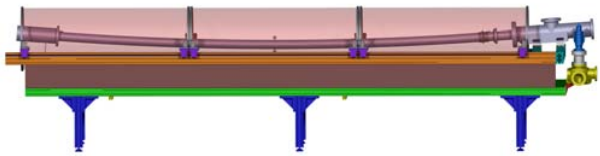

Figure 1: Drawing of the magnetron sputtering system, which will be used for the NEG coating of the HESR dipole chambers.

References

[1] M.C.Bellachioma et al., “Thin film getter coatings for the GSI heavy-ion synchrotron upgrade”, Vacuum 82, 2008, p.435

[2] M.Bender et al., “UHV-ERDA investigation of NEG coatings ”, Nucl. Instr.and Meth.B, Vol.268, 2010, p.1986 (2013) 56

[3] P.J.Spiller et al., “Acceleration of Intermediate Charge State Heavy Ions in SIS18”,IPAC 2010, Kyoto, Japan, p.669

[4] R.Toelle et al., “HESR at FAIR: status of technical planning”, PAC07, Albuquerque, New Mexico, USA

 doi:10.15120/GR-2014-1-FG-CS-14