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Develop of RF-plasma surface cleaning technique in the NSRC SOLARIS

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Contamination of the surfaces of optical elements i.e. mirrors, gratings and lenses with carbon is still a one of the major problems of soft X-rays beamlines. Reduced intensity of synchrotron light in the K-edge carbon region and deterioration of optics surface parameters like roughness and reflectivity is the most common consequence of carbon contamination. Many techniques and cleaning procedures were developed at synchrotron and laser facilities to address this problem [1-4].

In National Synchrotron Radiation Centre SOLARIS removal of the carbon contamination of optical elements has also been tackled and successfully accomplished by "in-situ" methods. While the "in-situ" cleaning techniques using zero-order synchrotron light at oxygen atmosphere (similar to [4]) have proven to be very effective for undulator sources, they have turned out to be ineffective for sources based on bending magnet due to insufficient photon flux in the UV range. To overcome this limitation we developed an in-house RF-plasma technique enabling removal of carbon contamination from optical surfaces, "ex-situ".

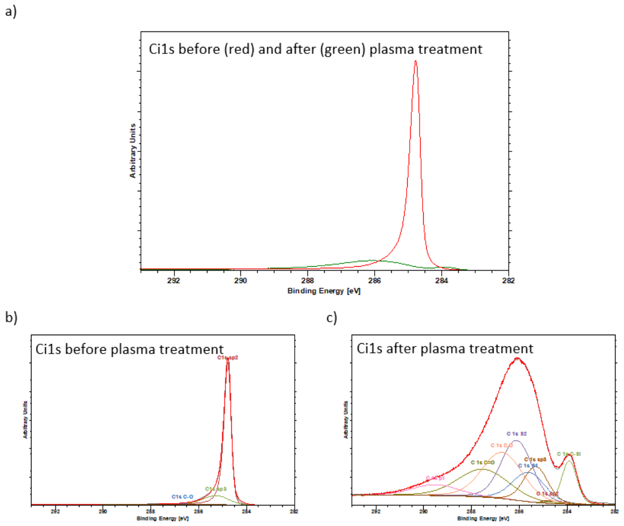

Figure 1 C1s XPS spectra measured with excitation energy of 400 eV for SiC sample covered with 7 ML of graphene and fits of C1s line before (a, b) and after air plasma cleaning process (a, c).

Our system is equipped with an aluminium antenna installed in the vacuum chamber that can fit optical elements inside. We performed some feasibility tests with low pressure (≈$5x10^{-2}$ mbar) air and nitrogen plasma. We made use of graphene samples prepared on SiC substrates (7 ML of graphene/SiC). The high-resolution XPS spectra of graphene/SiC samples (Fig.1a) collected after air plasma treatment reveal a significant reduction of carbon signal from the surface. Further tests on beamline optical elements are in progress.

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References

[1] F. Eggenstein et. al, Proc. SPIE 10385, Advances in Metrology for X-Ray and EUV Optics VII, 1038505 (7 September 2017)

[2] H. M. Fernandez et. al. , J. Synchrotron Rad. (2018). 25, 1642–1649

[3] E. Pellegrin et. al. , J. Synchrotron Rad. (2014). 21, 300–314

[4] A. Toyoshima et. al. , J. Synchrotron Rad. (2012). 19, 722–727