A.7 Development of System for Synchrotron Optics Cleaning

Synchrotron optical elements are used in high /ultra-high vacuum environment. Even in this environment, carbon contamination is practically unavoidable in the presence of intense x-ray synchrotron beam. Generally, synchrotron mirrors are coated with materials like gold to get high reflectivity. Carbon contamination decreases the reflectivity. A RF plasma system, based on cleaning by oxygen plasma has been developed and tested for a glass substrate coated by carbon soot as well as by vacuum evaporation of carbon.

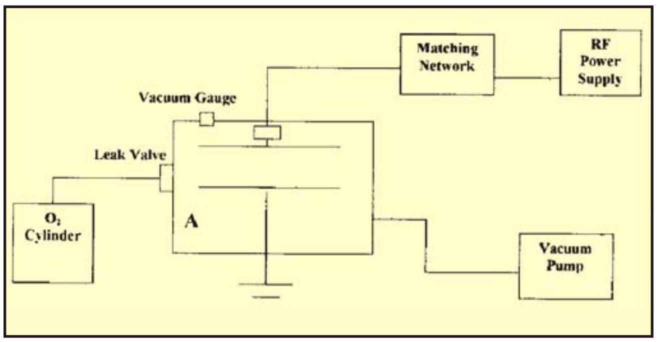
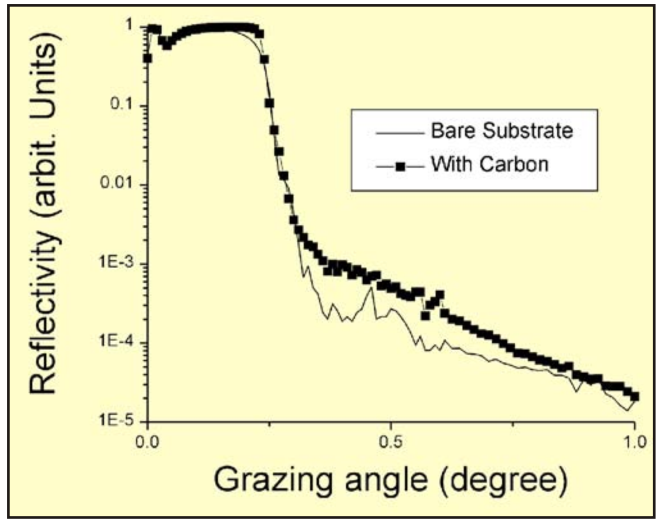


Figure.A.7.1 shows the schematic of the synchrotron optics cleaning system. RF supply is applied between parallel plates of a capacitor (Rectangular geometry of area 300mm x 500mm and gap 10mm), through an impedance matching network (impedance of 50 ohms). Maximum power output of 50W, at a frequency of 27.12 MHz has been used. A dual power meter is used to measure the forward as well as the reflected power. The powered electrode is isolated from the SS chamber by Teflon rod. The lower electrode is grounded. Oxygen cylinder supplies pure oxygen and the flow rate is adjusted using an all-metal precision leak valve. The vacuum chamber is pre-evacuated to a pressure of 10^{-7} Torr using a turbo-molecular pump. TMP is then switched off and the system is evacuated using a rotary pump, during the plasma is on. A pressure of 0.1Torr to 10 Torr is used during cleaning. For the results shown, the cleaning has been performed for 12 hours.

Hard x-ray reflectivity of float glass substrate and float glass substrate coated with vacuum evaporated carbon film are shown in fig. A.7.2. X-ray reflectivity after oxygen plasma treatment almost merges with that of the substrate. Hence, cleaning is satisfactory. A gold coated substrate after cleaning showed that there is no damage to the gold coating, as measured by transmission of visible, near IR spectrum.



(Contributed by: A.K. Sinha; anil@cat.ernet.in)

A.8 Series Testing of Superconducting Magnets using SC Switch

Superconducting Technology Lab, Magnet Division is engaged in manufacturing & testing of large number of Superconducting (SC) Corrector magnets for the LHC projects at CERN. The magnets undergo a series of qualification tests prior to the shipment. One of the important tests is cryogenic training at 4.2 K under LHe by powering them to rated test current. Conventionally, in order to train 'n' number of magnets, 'n+1' number of current leads are required to charge them when connected in parallel. This results in high static heat load, as current leads are the major source of heat leak in to the cryostat. Also the testing in such scheme is quiet cumbersome requiring change of lead terminals externally each time. The initial testing capacity with this scheme was up to six magnets per day using seven current leads with one as common.

Apparently, each magnet is also fitted with a SC switch in parallel for measuring the contact resistance (coil joints) of the magnet. We designed an innovative scheme by connecting the magnets under test in "*series*". The current flow is controlled using SC switch, to be able to test the particular magnet. In principle, just two current leads are required in this scheme, however we have taken three current leads with two circuits of six magnets each to avoid problem of maintaining LHe level for immersion of magnets.