A.4 Indigenous development & batch production of UHV components for Indus-2

A.4.1 Photon absorbers

Photon absorbers are installed in the down stream of bending magnet chambers in Indus-2 to absorb non-experimental synchrotron radiation. Grazing incidence water-cooled photon absorber (without any water to vacuum joint) were designed & developed to dissipate the high power density of 10.5kW/cm^2 (normal incidence). Fabrication of helium leak tight UHV compatible assembly of photon absorber is an important task in the fabrication of UHV system of Indus-2. The success of assembly requires special considerations at various stages like geometry design, FEM thermal analysis, material testing, profile machining on CNC, vacuum furnace brazing & quality assurance. There are 64 such photon absorbers (4 in each BM chamber) mounted in Indus-2 storage ring. 80 nos (keeping 16 spares) were planned for production in 5 batches. So far production of 4 batches has been completed & 5th one is in progress. Photograph of a typical photon absorber is shown in fig. A.4.1.

Fig. A.4.1 Photon Absorber for Indus-2

A.4.2 RF-shielded bellow assembly

The radio frequency (RF) shielded bellow assembly has been designed & developed for the Indus-2 electron storage ring. The RF-shield is a usual finger type but has a special cantilever type spring-finger to press the contact finger to the beam tube. It is a flexible mechanical structure that maintains good electrical contact between adjoining Al-alloy vacuum chambers while absorbing the thermal expansion during beam operation or baking.

It reduces the excitation of higher order modes, ensures smooth flow of image (wall) current. Critical stages in the development of RF-shield are: design and FEM analysis, wire-cutting and forming, precipitation hardening, heat-treatment in vacuum furnace and plating. 44 bellow assemblies are required to be installed in Indus-2. The photograph of a typical RF-shielded bellow assembly is shown in fig.A.4.2.

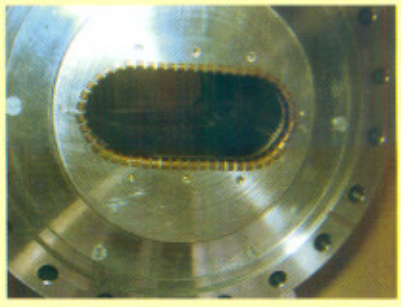

Fig. A.4.2 RF-shielded bellow assembly for Indus-2

A.4.3 Diamond seals

A highly reliable & low cost UHV compatible Al-alloy gasket called "diamond seal" has been designed and developed for connecting Al-alloy vacuum chambers (homogeneous joints) as well as vacuum chambers to auxiliary UHV hardwares like stainless steel (SS) ion pump, gauges and bellows etc (heterogeneous joints). Material of construction for these seals is Al6063-T5. So far, 300 Nos in various sizes have been successfully produced and are ready for use. Sketch of a typical UHV demountable joint, consisting of diamond seal is shown in fig.A.4.3.

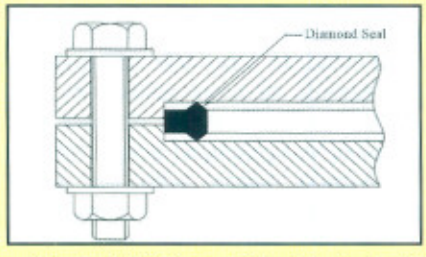

Fig. A.4.3 Diamond Seal for Indus-2

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A.5 Grazing incidence hard x-ray reflectometer

Grazing incidence x-ray reflectivity technique is a non-destructive method for the characterization of surfaces and interfaces on atomic scales. X-ray reflectivity (XRR) profiles are extremely sensitive to film thicknesses, layer compositions and interface roughness. To measure XRR, one needs a collimated radiation of a low angular divergence along with the precise control over incident and exit angles (≈0.001°). The large dynamic range (≥10^5 counts) is required to scan the large angular range and that needs the high intensity x-ray source. In brief, to realize a complete XRR setup one requires precise goniometer, high intensity source, beam collimator, detector and monochromator and finally the skill to put them all together in a specific manner.

In CAT, the grazing incidence reflectometry work