ACCELERATOR PROGRAMME

Development of UHV grade Aluminum to stainless steel tubular transition joint

The RF Cavity for the storage ring of the SRS facility will be made of aluminum alloy 6061 T 6 and will operate under Ultra High Vacuum (10^{-9}Torr). The use of metal gasket on all port flanges therefore becomes unavoidable. There is, however, considerable difficulty, in making demountable joints with aluminum alloy flanges using metal seals. This is because of the low hardness of non heat treated aluminum alloys. To overcome this problem tubular UHV grade transition joints between aluminum and stainless steel were developed and these will be used in the RF cavities for Indus-I and Indus-II.

Conventional fusion welding technique cannot be used to make these transition joints because highly brittle intermetallic compounds are formed during this process. Therefore techniques like explosion bonding, and friction bonding were tried. The explosion bonded pieces were found unsuitable for UHV grade transition joints as they had leaks of the order of 10^{-7} Std-CC/Sec in the direction of symmetry of the wavy interface of the bond. However these joints passed all the mechanical tests for strength and ductility and thus can be used for less demanding vacuum applications. Friction welding of Aluminum (99.0%, annealed) to Stainless Steel AISI-304 has yielded satisfactory mechanical properties and leak rate. The joints passed the bend test and the tensile test with joint strength of 16 kgf/mm^2. No detectable leak was found in helium leak tests at the sensitivity level of 10^{-9} Std-cc/Sec. These tests ensure that the developed transition joints would be suitable for UHV applications. The joints were developed in collaboration with Welding Research Institute, Tiruchirapalli using a continuous drive friction welder. Work is also in progress for developing transition joints using diffusion bonding technique.

RF cavity for booster synchrotron

The RF cavity for the 700 MeV booster synchrotron for the SRS facility is under fabrication at CAT and is expected to be ready soon. It has been designed to operate at 31.613 MHz with a provision for tuning the frequency and to sustain a gap voltage of 45 kV under high vacuum conditions (10^{-7} torr). The design values for shunt impedance and unloaded Q are 397 kΩ and 5410 respectively. The cavity, made of aluminum alloy 6061, is a cylindrical structure of 880mm diameter and 900mm length, with re-entrant drift tubes having capacitive plates. The fabrication of the cavity has involved development of UHV grade weld joints of 25mm thickness in aluminum alloy 6061 with minimum distortion due to welding so that stringent tolerances required in the cavity can be achieved.

The RF cavity under inter-stage helium leak test during fabrication.

INFRASTRUCTURAL DEVELOPMENT

IN-HOUSE FACILITY FOR GLASS & CERAMIC WORK

The glass & ceramic techniques section provides in house facilities for glass and ceramic working. It has two glass blowing lathe machines (one 75mm and the other 200mm bore), annealing ovens of 610 X 610 X 610mm^3 and arrangements for table top glass blowing. Diamond cutting and lapping machines have been installed for cutting and grinding of glass and ceramics. The section also has a hydrogen furnace (150mm diameter X 300mm length) and a RF induction heater of 18 kW capacity for development of ceramic to metal seals of both tubular and feed through types. A controlled atmosphere furnace, for temperatures upto 1550°C, with chamber size of 250 X 300 X 350mm^3 is being commissioned.

The glass and ceramic technique section has also taken up work related to development of several critical components for accelerators and lasers such as ceramic to metal sealed feed throughs, electron guns for linac and electron beam welding machine, emitter for microtrons, sealed off fixed anode X-ray tubes of 1.5-2 kW, quadrupole residual gas analyser gauge heads, sealed off sparkgaps and various types of laser tubes. Of these, self triggered spark gaps with breakdown voltages ranging from 8 kV DC to 15