

A.8: Development of a CBP machine for 650 MHz SCRF cavity

A Centrifugal Barrel Polishing (CBP) machine has been indigenously designed and developed to remove a thin layer (~ 100 μm) and to polish the internal surface of multi-cell SCRF cavity. Good internal surface finish is one of the prime requirement of a SCRF cavity to improve the quality factor of the cavity. The surface finish requirement for a SCRF cavity is that it should be better than 100 nanometer. Centrifugal barrel polishing is one of the mechanical polishing techniques to polish the internal surface of SCRF cavity. A CBP machine has been designed and developed with the help of an Indian industry.

CBP machine has four barrels of to accommodate a five-cell 650 MHz SCRF cavity. The barrels are designed to take a load of five-cell 650 MHz cavity, cavity holding fixture and polishing media. Fig. A.8.1 shows a schematic layout of the CBP machine.

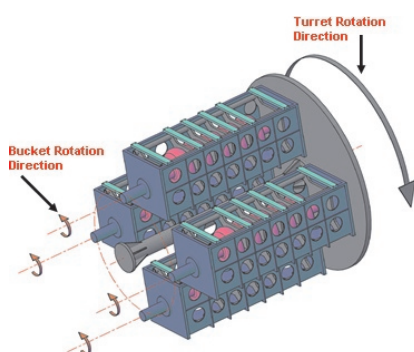


Fig. A.8.1: Schematic layout of the CBP machine

The machine has two major parts viz. turret and barrel. All four barrels are supported by turret. Rotational axes of turret and barrel are parallel to each other. Turret and barrels rotates in opposite direction to each other. The cavity to be polished is half filled with polishing media and water (Fig. A.8.2).

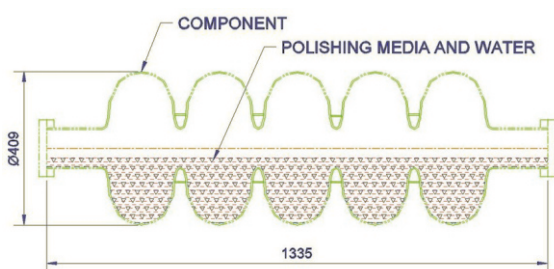


Fig. A.8.2: 5 Cell 650 MHz SCRF cavity filled with polishing media & water

Material removal takes place due to the centrifugal force exerted by the polishing media on the internal surface of the cavity. Ceramic and plastic abrasive media are used for major material removal and polishing is done with the use of corn cob & colloidal solution.

Belts and chains are used to drive turret and barrels respectively. Separate motors are used for turret and barrel rotation. Barrels and turret of the machine can be rotated individually and their speed can be varied from 50 to 200 rpm. Variable frequency drives are used to vary rotational speed. A special cavity holding fixture has been designed and developed to hold the cavity securely in the barrel is shown in Fig. A.8.3.

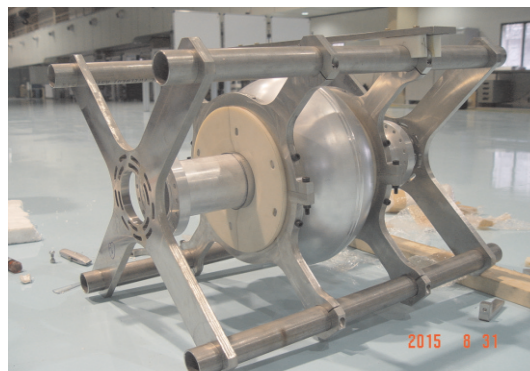


Fig. A.8.3: Cavity holding fixture to hold 650 MHz cavity

Cavity polishing cycle can be programmed for required period of operation and different combinations of rotational directions. Two air conditioners of two ton capacity each have been installed to remove the heat generated during polishing process. Fig. A.8.4 shows the centrifugal barrel polishing machine with a single-cell 650 MHz elliptical shape cavity loaded in the barrel.

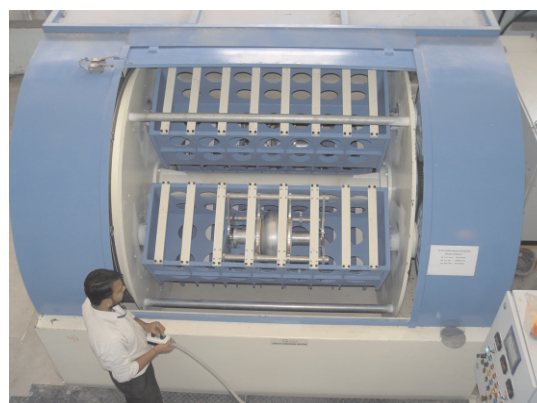


Fig. A.8.4: Centrifugal barrel polishing machine for 650 MHz SCRF cavity

The machine has been installed and commissioned at Proton Linac & Superconducting Cavities Division (PLSCD). A special foundation of 600 mm thick was made to grout the machine securely. Few cavity polishing trials have been conducted to polish the internal surface of a single-cell 650 MHz cavity. Process parameters are being optimized for polishing of 650 MHz SCRF cavity.

Reported by:
G.V. Kane, and S.C. Joshi (scjosji@rrcat.gov.in)