of acid, inside cells and so on and the fumes would been transported into neutralizing tower for filtering nitrogen dioxide and hydrogen fluoride.

There are several detectors used for monitoring the condition of the facility. The temperature probes are used for monitoring the temperature change of acids before and after etching. There are hazardous gas detectors in every cell, which are used for monitoring NO_2 and HF. A pH meter and a resistivity meter detect the acidity and resistivity of the rinsing water.

The facility could complete the BCP processing which includes acid mixing, sealing test, acid cooling, etching and water rinsing automatically, and the acid mixing cells and acid transporting cells could be used for S. C. niobium parts chemical etching machine and EP facility. The processing of automated BCP facility has been completed and it is waiting for installing.

6 - 15 Progress of Barrel Polishing of HWR Superconducting Cavity

Zheng Hai, You Zhiming, He Yuan, Xiong Pingran, Wang Wenbin and Shi Zhixiong

Barrel polishing (also called CBP or roll grinding and polishing) is generally used in polishing treatment of cell type Niobium cavity wall and able to remove irregularities like scratches and especially any roughness at electron beam weld seams. The mixtures of water and ceramic particles or plastic particles are put in Niobium cavity. By means of horizontal rotary of cavity, the polishing effect can be achieved by centrifugal force which leads to relative movement between abradant and cavity wall. Before chemical treatment to cavity, roll grinding and polishing are applied to wipe off thicker Niobium layer and then EP or BCP is used to remove thinner ones. There is no inner conductor for cell type Niobium cavity, so Niobium cavity can be effectively removed by roll grinding and polishing. The removal efficiency is related to abradant composition and rotate rate. At different rate, the polishing quantity could reach from 0.4 to 25 μm/h. But for HWR type cavity, the cavity is composed by internal and external conductor. With great current density, the inner conductor is the mainly distribution area of electric field. Therefore, the polishing effect of inner conductor should be considered when roll grinding and polishing are used to surface treatment for HWR type cavity. Small centrifugal force and appropriate addition of abradant are needed to polish internal conductor.

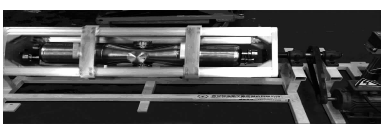

Fig. 1 Device of roll grinding and polishing.

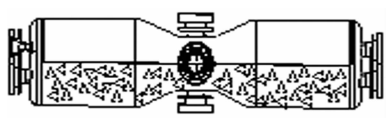

Fig. 2 Theory of polishing.

In order to obtain appropriate technology, different technological parameters were selected during roll grinding and polishing. The cavity was polished for two times and two kinds of parameter were adopted. The data is described as follow. Microstructure of cavity and removed thickness were investigated in detail.

Table 1 Polishing parameters

	Rotation rate (r/min)	Addition quantity (kg)	Proportion of volume (%)	Polishing time (h)
First time	42	3.7	23	96
Second time	60	9.7	58	96

The sampling shooting was conducted by endoscope at internal and external conductors in cavity after polishing, especially near weld joint at inwall.

For the first time polishing, little abradant was added, polishing material did not exceed the central line when held horizontally as shown in Fig. 2 and lower rotation rate was used. After 96 h rotation, internal conductor polishing was inefficient and much sputtering placed near weld joint. Meanwhile, external conductor polishing showed good effect and sputtering cannot be found.

Fig. 3 External conductor before polishing.

Fig. 4 External conductor after first time polishing.

Fig. 5 Internal conductor after first time polishing.

Fig. 6 Internal conductor after second time polishing.

More abradant was added for the second time polishing, the central line was over the central line and rotation rate was increased. After 96 h, the treatment for internal conductor showed remarkable effect. Sputtering barely existed near weld joint and cannot be removed thoroughly at weld joint due to larger particles.

Weighing calculation and averaging ultrasonic measured results of selected points were used as two ways to calculate thickness. The results of weighed thickness are shown in Table 2. It indicates that more abradant addition and higher rotation rates will lead to more efficiency of roll polishing.

Table 2 The removed amount of polishing

	Total amount (g)	Calculated thickness (μm)	Removed thickness per hour (μm)
First time	54	8	0.08
Second time	119	23.6	0.25

When the cavity surface was measured, a straight line was selected at same place. 22 points were selected averagely on the line and thickness of each point measured by ultrasonic. After the trend graph was obtained, average curve was got by fitting process. It should be noted that these graphs only reflect the overall variation tendency of thickness due to more curved surface of cavity and greater measured errors.

6 - 16 Summary of Ion Source Group Work in 2012

Sun Liangting

2012 is a very busy year. With the progress of many projects and scientific activitiesat IMP, more efforts from the ion source group are needed. The following contents are going to summarize the main contributions and achievements from the ion source group, which also leads to the scope of the activities in the ion source group for year 2013.

In addition to the two existing ion beam injectors SECRAL and LECR3, a third injector ion source LAPECR1 was installed and put into operation for HIRFL in 2012. This was made by the modification of the layout of the old injection line. The LECR3 ion source injection line was lengthened and a 90 degree bending magnet was inserted which was used to bend the ion beam from LAPECR1 ion source 90 and then merge to the LECR3 injection line. LAPECR1 source was floated on a compact HV platform that could be biased to 36 kV which enables the injection of intense light ion beams such as H^+ or H_2^+ with the energy more than 25 keV/q. The total operation time of the ion sources for HIRFL is more than 7200 h in 2012,