

conductor and the doorknob, a capacitance of 1300 pF was inserted. The insulating material was two layer of polyimide (like as Kapton) films of 0.125 mm thick.(4) The bias-type door-knob transitions were tested 450 kW transmission condition and 300 kW full reflection condition.

The bias voltage will be also used to suppress multipactoring in the input coupler after long term operation when multipactoring is known to reappear due to condensed gases on the outer conductor.

2 COUPLER PREPERATION

The coupler is shown in Fig. 1. The inner conductors were prepared some rinsing before RF processing. The rinsing process were followings.

1. Acetone rinsing after electron beam welding a electro polished inner conductor and a window.
2. ultra-pure water rinsing
3. ozonized water rinsing
4. ultra-pure water rinsing
5. dried by N₂ gas
6. evacuated at test stand

The outer conductors were electro plated by Cu using piro-phosphoric acid. And rinsed with pure water and sieled with N₂ gas. And

1. ultra pure water rinsing
2. ozonized water rinsing
3. ultra pure water rinsing
4. dried by N₂ gas
5. evacuated at test stand.

The inner conductor and the outer conductor tested at test bench up to 450 kW. The tested couplers were set at the cryostat using clean hut with small moving mechanism.

3 BIAS AGING

Before cooling down the cavities, we conditioned the input coupler up to 300 kW with full reflection condition, and up to 300 kW with DC bias voltage applied to the inner conductor up to ± 2 kV. This conditioning decreased the secondary electron emission coefficients of the inner and outer conductors and the ceramic window to less than or nearly equal to one. During this room temperature conditioning, the disrobed gas was evacuated to the vacuum ion-pumps. The multipactor around the input coupler, which is known to induce break down of the superconducting cavity during high power beam operation, was strongly reduced. By doing this the cavity could be operated at high power without beam processing of the input coupler. Figure 2 shows the vacuum activity at a given power that resulted from at bias processing.

When we applied DC bias voltages to the inner conductor up to ± 2 kV, on the starting at a bias voltage of +100 V, we observed light emission near the window on the test stand.(4) As the bias was increased throughout the range, many out gassing events were

observed, as shown in figure 2.

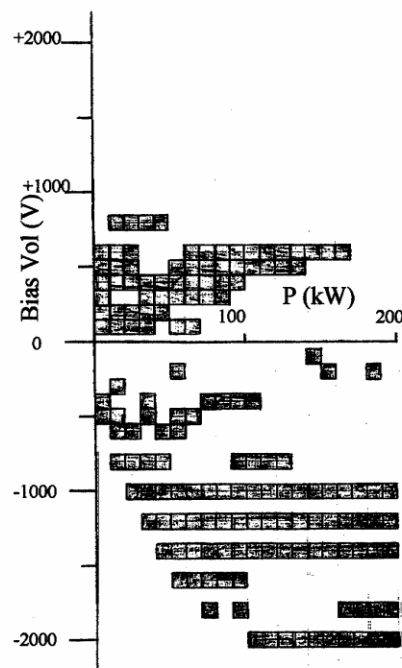


Figure 2: RF processing with bias voltage. Filled boxes show increasing vacuum pressure, which indicates multipactoring is occurring.

4 COUPLER OPERATION WITH BEAM

After the liquid helium vessel is filled to about 90 %, we try to raise the coupler power to 300 kW in an off-resonance condition, and raise the cavity voltage, V_c , up to 3 MV which corresponds to 12 MV/m or till breakdown(quench) occurs. Then we shift the phase of cavity up to ± 30 so that the field profile in the coupler changes in order to check and condition the less-conditioned parts of the coupler. Usually, no or slight out gassing is observed during this phase change conditioning. Conditioning at low temperature might be a source of gas condensation at the input coupler and superconducting cavity, so for the stable operation of coupler, the room-temperature bias conditioning is important. A more detailed study for this problem is being done.

The couplers handled RF power up to 380 kW to the beam with a beam current of 0.5 A. This is the highest power record for continuous operation in the world to date. Figure 3 shows the power transferred to the beam and the beam current. The maximum total power transferred to the beam was 1.4 MW by the 4 superconducting cavities.

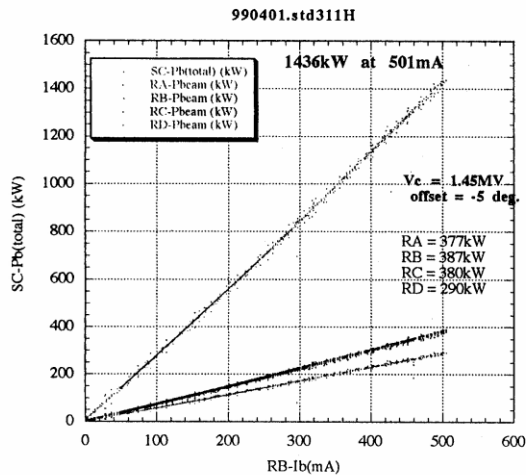


Fig.3 Power transferred to the beam and beam current.

5 SUMMARY

The high power input couplers for KEKB have been operated stably with high current beam. The RF processing with bias voltage is effective to reduce multipacting. The study to understand this mechanism will be continued.

6 REFERENCES

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