6 - 3 Design of High Voltage System for CSRm Cooler*

Ma Xiaoming, Mao Lijun, Yang Xiaodong, Li Jie, Tang Meitang and Zhao He

A new 20 kV high voltage system has been designed, developed and operated in CSRm cooler[1], in order to satisfy requirements of pulsed electron cooling experiments[2]. Series of FuG high voltage power supplies were used, including a 20 kV main power supply, two 3.5 kV DC power supplies for the anode and suppressor, a ±3.5 kV power supply for the grid, a 3.5 kV power supply with the maximum current of 3.0 A for the collector and a 20 V power supply for the filament. The sketch of the power supply system is shown in Fig. 1 and the main parameters of all power supplies are listed in Table 1. The residual ripple of the main power supply is around $10^{-5}$ (max. p-p value). A LAN interface was built in the main power supply, and other modules were communicated with the main power supply by optical fiber. A interlock system was used for the grid and anode power supplies, therefore the extracted electron beam can be cutoff quickly (<10 ms) while the leakage current of the main power supply is over threshold.
Table 1: Main parameters of CSRm electron cooler high voltage system.

<table>
<thead>
<tr>
<th></th>
<th>Voltage/kV</th>
<th>Max.current/mA</th>
<th>Power/W</th>
<th>Input/V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>−20</td>
<td>15</td>
<td>300</td>
<td>220</td>
</tr>
<tr>
<td>Anode</td>
<td>+3.5</td>
<td>10</td>
<td>35</td>
<td>220</td>
</tr>
<tr>
<td>Grid</td>
<td>±3.5</td>
<td>10</td>
<td>35</td>
<td>220</td>
</tr>
<tr>
<td>Filament</td>
<td>0.02</td>
<td>6000</td>
<td>120</td>
<td>220</td>
</tr>
<tr>
<td>Collector</td>
<td>3.5</td>
<td>1500</td>
<td>5250</td>
<td>380 (three phases)</td>
</tr>
<tr>
<td>Suppressor</td>
<td>3.5</td>
<td>10</td>
<td>35</td>
<td>220</td>
</tr>
</tbody>
</table>

Three operation modes, including the DC mode, pulsed electron beam mode and modulation energy mode are provided by the new high voltage system. It is convenient to change the operation mode freely within three modes. Based on the new system, a Dielectronic Recombination (DR) experiment and a pulsed electron beam cooling experiment have been carried out in CSRm successfully[3].

References

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6 - 4 Design of Gun and Collector for Electron Cooler of HIAF*

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The 100 kV electron cooler device is designed for the new project HIAF to improve beam quality in SRing[1-2]. The design work of the electron gun and the collector for the cooler has been finished and the prototype has being manufactured in the workshop. The structures of the gun and collector are shown in Fig. 1.

![Fig. 1 (color online) Structure of the electron gun (left) and the collector (right).](image)

The electron beam trajectory in the gun and collector was simulated by the program UltraSAM[3]. The secondary electron beam of the collector has significant effect on the vacuum, which associated with the stability of the high voltage power supply of cooler. To simulating the emission of secondary electron beam in the collector and optimize the collector, a method based on the Monte Carlo have been developed. In the method the electron beam