6 - 29 Primary Studies of Flashboard in High Current Pulsed Electron Gun

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The requirements on beam current and pulse widthfordielectric wall accelerator (DWA) testneed to design a new type of high current pulsed electron gun. Thermionic sources were problematic becauseof the close proximity to plastic components ofthe DWAthat might deform or outgas when heated. Photocathodes wouldmake the present laser systemmore complicated due to the use of photoconductiveswitching. Plasma cathodes, in which an electric field is usedto extract electrons from plasma, avoid the mentioned problems andare capable toproduce high current-short pulse electron beam[1].

The plasma cathodeadopted the vacuum spark discharge technology. The plasma will be generated on the dielectric surface by the vacuum spark and the electronswill be extracted by PFL(pulse forming line)s. Then the high current electron beam with short pulse will be delivered into the DWA to test the accelerating mechanism.

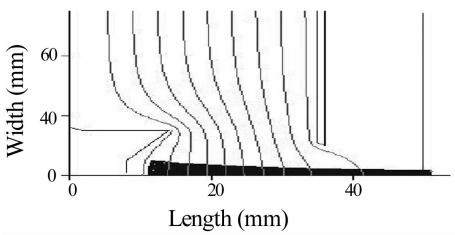

Fig. 1 The simulated result of the pulsed electron gun.

The flashboard is the keycomponent in thispulsed electron gun. We have to design the prototype of flashboard for the test firstly. The flashboard is anelectron emission device which caninduce surface flashover to generate plasma by applying a high voltage pulse across the small triangular gaps which machined into the copper in printed circuitboards. The gaps will be limited to about 0.2 mm width. In order to validate the correctness of this idea, we made a primary test about the flashboard in the atmosphere. The experimental results showed when the voltage of the pulse signalreached 0.3 kV, some of the gaps began to spark. When the voltage reached 8 kV, almost all the gaps began to spark. It confirms this method can be adopted for the high current pulsed electron gun.

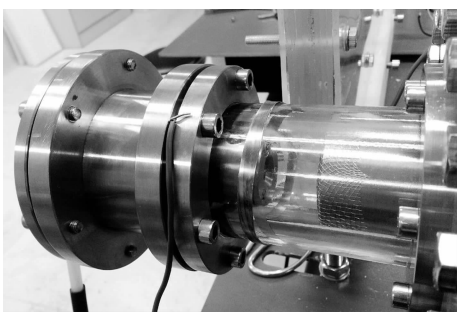

Fig. 2 The pulsed electric gun in DWA.

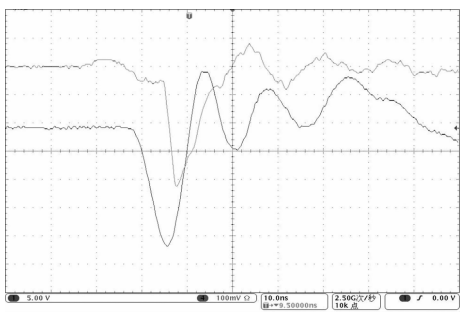

Fig. 3 The measurement of the electric gun.

After the tests in the atmosphere, weplan to test the flashboard in the vacuum. First of all, the design ofelectron gun's structurehas to be done, so we simulated the electric field by EGUN, which confirmed the structure has a good laminar flow.

Fig. 3 shows the measurement result of the electron gun installed in DWA. When the pulse voltage reached 4 kV, the beam current was 100 mA. The electric gun basically met the design requirements, verified the design idea.

Reference

[1] J. R. Harris, et al., IEEE Transactions on Plasma Science, 37, 6(2009).