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Researching On the Power Sources Decoupling at IFP's Dielectric Wall Accelerator

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Dielectric Wall Accelerator (DWA) is a new type of pulsed linear accelerator. Its working mechanism is regulating the discharge order of different power sources to keep the accelerating electric field present near the particles all the time, and it is really suitable for heavy ions acceleration. The Institute of Fluid Physics, China Academy of Engineering Physics (IFP, CAEP) began the research on DWA since 2011, and had built a sample DWA for proton acceleration. During the debugging process of the DWA, it was found that the coupling between adjacent power sources in the discharge circuit will lead to a sharp drop of the accelerating voltage on the accelerating cavity, and the energy gain of proton is much less than expected. In this paper, the research on the coupling between power sources was studied and a new electrode structure which can reduce the coupling between adjacent power sources was put forward. And three-dimensional electromagnetic simulation software was used to compute the electric field distribution under the new structure. The results showed that the new electrode structure successfully blocked the discharge circuit between power sources, and the coupling between the power sources was effectively suppressed, the voltage on a single accelerating cavity was significantly increased. Even though there will get decelerating electric field presenting at the new electrode structure. The simulation result showed the amplitude of decelerating electric field was limited, and the influence to particle energy gain was negligible by the electric field path integration, particles can still get high gradient acceleration. The experimental results of the voltage loading on the accelerating structure also showed the effectiveness of the improved structure.

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