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**Study on the D/Ti ion ratio of metal deuteride cathode vacuum arc ion source**

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Based on the violence vacuum arc discharge mode, we can simply and easily obtain a large number of ions and atomics compositions. When the discharge cathode is made of metal deuteride, it can generate high current pulsed deuterium ion beam, which have been widely studied and used in neutron generators, accelerators and other fields. The ions compositions that produced by metal deuteride cathode vacuum arc discharge are analyzed in this paper by the magnetic analysis technology. We study the metal deuteride electrode discharge and the D/Ti ion ratio with different deuterium content. The effects of the TiD<sub>x</sub> cathode deuterium content (x) on the D/Ti ion ratio in vacuum arc ion source are analyzed in this paper. In addition, the metal deuteride electrode discharge with different TiD<sub>x</sub> cathode surface roughness is studied and the effect of the TiD<sub>x</sub> cathode surface roughness on the stability of ion ratio is analyzed. The experimental results show that the increase of deuterium content on the TiD<sub>x</sub> cathode can significantly improve the D/Ti ions ratio in the vacuum arc discharge. Besides, the results indicate that suitable cathode surface roughness can increase the stability of the vacuum arc discharge.

**Key words:** vacuum arc discharge, TiD<sub>x</sub> cathode, magnetic analysis, D/Ti ion ratio, surface roughness