Arc discharge characters of bucket ion sources with different magnetic configurations for neutral beam heating on HL-2A and HL-2M Tokamak

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Magnetic multi-pole line-cusp configurations are wildly used in Bucket ion sources of Neutral Beam Injectors to well confine primary electrons and get higher arc discharge plasma density. To investigate the influence of magnetic configurations on arc discharge efficiency, several circular bucket ion sources with different magnetic configurations are manufactured, which have 36 lists of magnets, 20 lists of magnets, 7 circles of magnets on the side of the arc chambers and are 24cm or 21cm in depth. With scanning arc current, arc discharge efficiency is obtained both for choosing hydrogen and deuterium as discharge gas. With the same discharge conditions, the extracted hydrogen beam is higher than the extracted deuterium beam and the extracted currents are almost the same for the ion sources with different magnetic configuration structures. This indicates that the conventional model for ion loss width on the magnetic cusp lines needs to be improved.

Recently, a rectangular bucket ion source is manufactured. The requirements for this ion source is a 80kV/45A/5s deuterium beam. The dimensions of the arc discharge chamber are a cross section of $560 \times 266\,\text{mm}^2$, and a depth of 240mm. For removing and adding floating plates between the electron dump plate and filament plate, and between the filament plate and anode bucket, difference in arc discharges will be investigated shortly.