§2. Single Electron Detachment from Negative Hydrogen Ion in Collisions with Positive Ion at High Energies

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The injection of fast and powerful neutral hydrogen beam (H^0) is believed to be one of the most efficient methods for plasma heating. The detail understanding of the electron detachment processes from negative hydrogen ion is important for Neutral Beam Injection (NBI) for plasma heating.

Thus we have calculated the total cross section for electron detachment from negative hydrogen ion colliding with proton at high incident energies.

The reaction in the electron detachment considered is

$$H^+ + H^- \rightarrow H^+ + H^0 + e^-. \quad (1)$$

The projectile system of the negative hydrogen (H^-) ion is assumed to be in the ground state and can be described approximately by the Hylleraas-Eckart function [1] which includes two different bound electrons in negative hydrogen, one being the weakly bound state (1s') and another the strongly bound state (1s) on the other hand, the detached electron is described with the plane wave in the exit channel.

Our present calculation is based on the four-body Continuum-Distorted-Wave (CDW-4B) approximation [2,3].

Figure 1 shows comparison of our calculated results of reaction (1) with experimental data [4]. In the intermediate energy region, our result is close to experimental data. Unfortunately, there is no experimental data in high energy region so far.

In order to compare with the present results, we also show the calculated results for

$$H + H^- \rightarrow H + H^0 + e^-. \quad (2)$$

These results clearly show that the cross section for reaction (1) is a factor of 4~5 bigger than those for reaction (2), suggesting that reaction (1) is more effective in production of neutral hydrogen atom from the negative hydrogen ions.

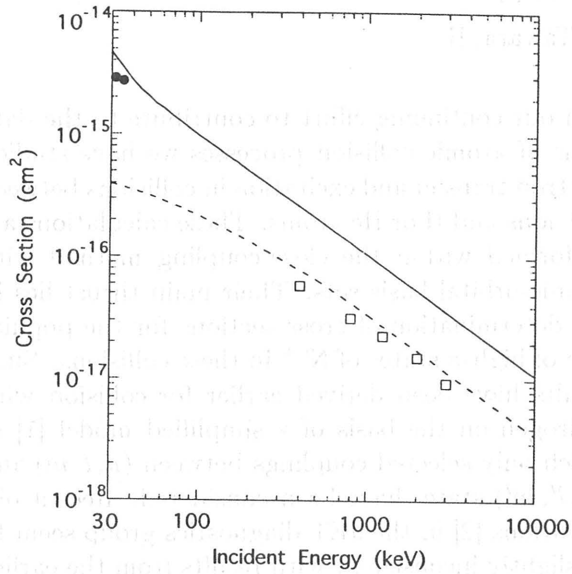

Figure 1: Comparison of the calculated results with experimental data of reaction (1), the calculated result and experimental results of reaction (2). The solid line represents the present calculated results of reaction (1), solid circles represent experimental data [4] of reaction (1), open squares represent experimental data [5] and dash line the calculated results [6] of reaction (2).

References

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