§ 2. Atomic Data Evaluation and Data Fitting

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Atomic processes in plasma are important elementary processes for plasma modeling and diagnostics and atomic data used in them should be reliable. Data evaluation is important to provide such reliable data for users.

Charge transfer process between impurity ions and neutral hydrogen from neutral beam injection (NBI) is used as one of plasma diagnostics tools. Spectrum from the impurity ion after capturing an electron from the neutral hydrogen (charge exchange recombination) is measured and gives us some information, such as abundance of the impurity ion, electron temperature, and etc. There were some experiments of pellet injections into plasmas of the LHD and the CHS. The pellets consist of polystyrene shell and LiH core and can deposit Li ions at the central region of plasma. Such tracer encapsulated solid pellets were used to examine plasma transport. For analyzing spectra from Li ions, state-selective charge transfer cross sections are needed at NBI injection energy as well as low collision energy region which is important to remove background effect in the peripheral region where neutral hydrogen is produced near the wall.

We collected all available data for Li^{3+} + H --> $Li^{2+}(nl)$ + H^{+} collision process for wide energy range, stored in the database, CHART[1], and evaluated them. Since such state-selective cross sections are obtained by theoretical calculations, we examined the calculation methods whether they are valid for considered energy range. That is, the method MO gives good results at low energy region (less than 10keV), the methods AO and CTMC are good at intermediate energy region (10keV-100keV), and the methods AO and Born Approximation are good for high energy region (larger than 100keV). With this guideline, we selected data and obtained evaluated data. At low energy region data are limited and sparse, so detailed energy dependence of the cross sections is unknown. For processes into higher excited states (n>6), data with high energy region are only available, and we cannot estimate whole energy range. Those evaluated data have been fitted with analytic form with the program which we developed in the previous year.

[1] NIFS database http://dbshino.nifs.ac.jp/

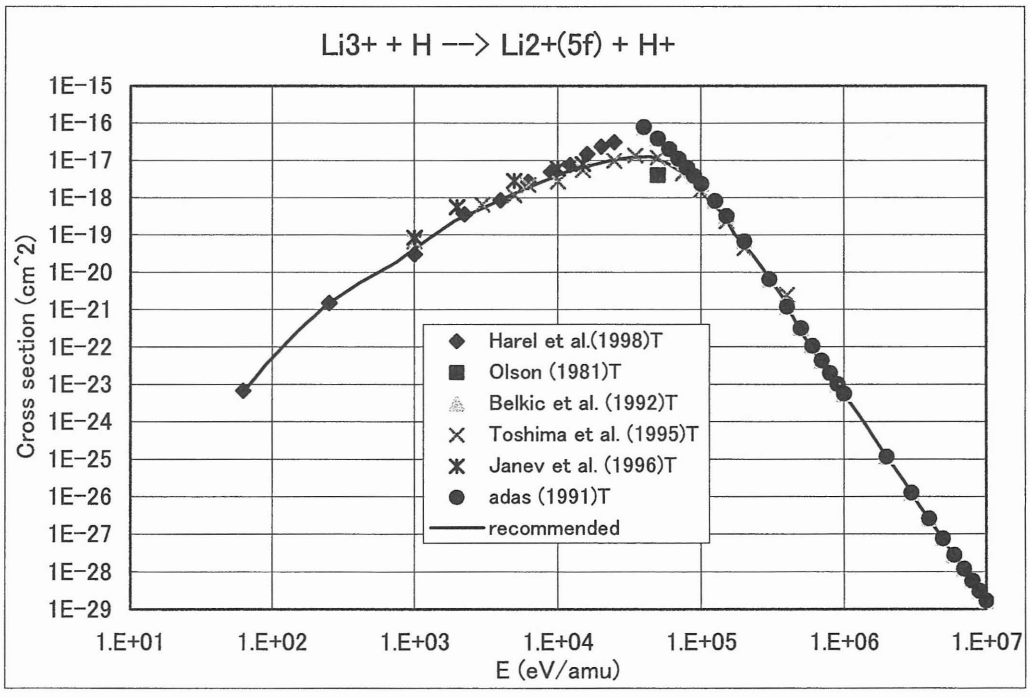

Fig. 1: Cross section for charge transfer process Li^{3+} + H → Li^{2+} (5f) + H^{+} as a function of collision energy. Recommended data is shown as a solid line. Data from Belkic et al. and ADAS database are basically the same.