

## §7. Atomic and Molecular Numerical Databases and Data Activities

Murakami, I., Kato, D., Kato, M., Sakaue, H.A.

We have constructed and made public atomic and molecular (AM) numerical databases for various collision processes, mainly for fusion plasma research but also for other areas such as astrophysics, applied-science with low temperature plasmas, plasma processing, etc. The AM data activities in Japan were initiated in 1970s.

The current web accessible database system<sup>1)</sup> has been opened and maintained since 1997. The database system consists of 6 sub databases. Table 1 shows a list of AM and PWI numerical databases. For a bibliographic database “ORNL” original data records are collected by Oak Ridge National Laboratory (USA). Cross references are partly supported between bibliographic and numerical databases. Users can retrieve numerical data through the web form by element, ionic stage, initial states and other constraints.

The databases include: “AMDIS” for cross sections and rate coefficients for electron impact ionization, excitation, recombination, and dissociation; “CHART” for cross sections of heavy particle collisions; “MOL” for numerical data on molecular collision processes, “SPUTY” for numerical data on sputtering yields for mono-atomic solids and “BACKS” for numerical data on reflection coefficients.

During the 2012 fiscal year, we mainly updated the data for AMDIS and MOL. A list of publications which data are newly included to the database is shown as “What’s new” window of the database homepage<sup>1)</sup>. Fig.1 shows an example of recombination rate coefficient for  $C^+$  ion<sup>2)</sup>, which includes new experimental data. A working group has been organized to collect data systematically, and data on collision processes for light elements were searched in FY2012.

In addition to the main databases, we have several small satellite databases and they do not have retrievable systems. These satellite databases are linked to the top page of the main database and numerical data are available as a text file. During 2011 and 2012, we have prepared a web page for a bibliographic database of electron – molecule collision processes, compiled by M. Hayashi. Some bibliographic databases are already published as NIFS-DATA series<sup>3)</sup>. This bibliographic database is now ready to open and recommended cross section data sets for some molecules by Hayashi are soon to be open in a web page as well. Fig. 2 shows Hayashi’s

recommended data set of electron-impact cross sections for  $C_3H_8$  molecule as an example.

Table 1. AM and PWI databases

Name	No. of Records*	Period
AMDIS	671,972	1929-2012
CHART	7,054	1940-2010
MOL	3,872	1956-2009
SPUTY	1,241	1931-2000
BACKS	396	1957-2002
ORNL	78,097	1959-2009

\* as of May 23, 2013.

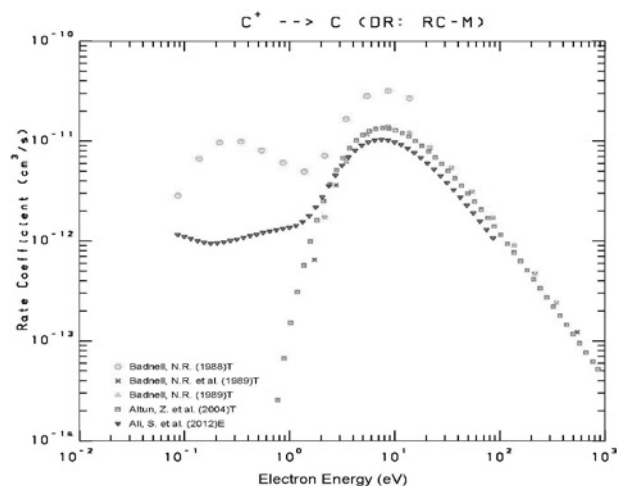


Fig. 1 Dielectronic recombination rate coefficients for  $C^+$  ion and new experimental data ( $\nabla$ ) [2] are included.

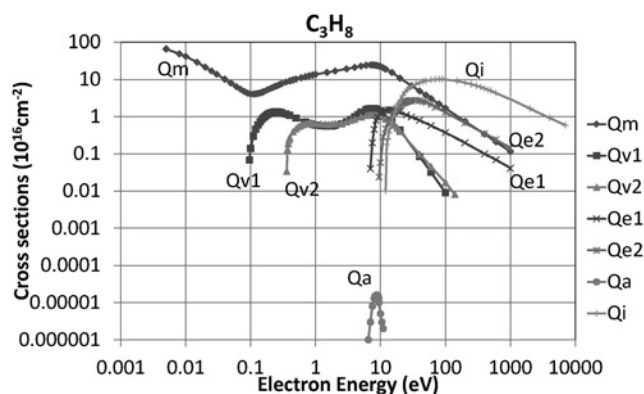


Fig. 2 Recommended data set for cross sections of electron-impact processes for  $C_3H_8$ . Data are compiled by M. Hayashi. Qm: elastic momentum transfer,  $Q_{vn}$ : vibrational excitation  $n$ ,  $Q_{en}$ : electronic excitation  $n$ ,  $Q_a$ : electron attachment, and  $Q_i$ : ionization cross sections.

1) NIFS Database, <http://dbshino.nifs.ac.jp/>

2) S. Ali et al., *ApJ* **753** (2012) 132.

3) M. Hayashi, NIFS-DATA 72 ; 74 ; 76 ; 77 (2003) ; 79 ; 80 ; 81 ; 82 ; 83 ; 87; 90 (2004).