

§20. Network of Atomic and Molecular Database Related to the Processing Plasmas

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Up to now the National Institute for Fusion Science (NIFS) has compiled and evaluated databases for fusion science. A globe spanning information network has been setup involving the academic and energy science networks in the USA. This network enables individuals, universities and other institutions all over the world to access the computers and data services of NIFS, enabling effective joint research. As a challenge for the 21st century compilation and evaluation of these databases, so invaluable for science development and the industry, needs to be enlarged to include data from other areas of science and engineering. In this project, we search for reliable atomic and molecular databases for further development of the plasma processing technology (e.g. vertical integrated computer-aided design for device processing), and aim at establishing a network of such databases. Through the database network, an effective trinity symbiotic relation among the NIFS, universities, and industries would be formed. From this viewpoint, consultative meetings were held at NIFS in December 2004 and March 2005.

This project seeks to know the currently available data gathered by individuals, universities and other research centers. In the US, the group led by L. G. Christophorou, at the National Institute for Science and Technology (NIST)¹⁾, had devoted itself to data compilation and evaluation for some important molecules related to plasma processing. However the project has since ended. Other related works include those carried out by individuals for companies (e.g. W. L. Morgan, for Kinema Research & Software)²⁾ and universities in conjunction with companies (e.g. V. McKoy

and C. Winstead, for Intel)³⁾. In the EU, some French group has privately compiled databases for plasma processing gases. In Japan, the Investigation Committee on “Discharge Plasma Electron Collision Cross-Sections”, in the IEE Japan⁴⁾, started the similar project about 5 years ago. They tried to compile swarm experiments databases related to plasma processing at Hokkaido Univ., Kitami Inst. of Tech., Muroran Inst. of Tech., Chiba Inst. of Tech. and Keio Univ. They evaluated relevant data from all over Japan, with some international references, and made recommended databases, e.g. CF₄. After discussion on some technical and copyright issues, we have obtained their consent to have a link to their database from the NIFS database.

A meeting with some companies (PEGASUS Software Inc., WaveFront Co. Ltd., ULVAC Inc., and Hitachi Ltd.) was held to listen to current status of industrial applications of A&M data to the plasma processing. The data needs are high and include variety of processes, but available data is limited. For application to plasma processing by using atmospheric discharge, Prof. Y. Ichikawa (ISAS, emeritus Professor) was invited at the meeting to present his work on new data compilation and evaluation for electron collision cross sections of N₂ target.

Prof. M. Hayashi (Gaseous Electronics Institute, past away on Dec. 7, 2004) did extensive work in compiling references for various molecules, in a series of publications called the “Bibliography of Electron and Photon Cross Sections with Atoms and Molecules, NIFS-DATA Series”. However, there are still many bibliographic data compiled by him remained unpublished. These data are being prepared for publication in the NIFS-DATA series by Prof. Y. Nakamura (Keio Univ.).

References

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