

## §7. Search for Atomic and Molecular Databases Related to Plasma Processing Gases

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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 21<sup>st</sup> 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. This project aims at searching for reliable atomic and molecular databases for further development of the plasma processing technology (e.g. vertical integrated computer-aided design for device processing). From this viewpoint, consultative meetings were held at NIFS in July 2003 and February 2004. The following decisions were made, and a number of e-mail correspondences done to polish up the roadmap for the collaborative research.

*Current Status of the Database:* In the first year, 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

“Discharge Plasma Electron Collision Cross-Sections”, in the IEE Japan [4], started similar projects 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. CF<sub>4</sub>. M. Hayashi of the Gaseous Electronics Institute also 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, RESEARCH REPORT NIFFS-DATA Series”.

*Future Direction:* Although these databases have become so invaluable in this century, more than ever before, the two big projects at NIST and Caltec have ended, and only the Kinema research business project remains. The activities of the swarm experimental groups in Japan are slowly dwindling, and only a few researchers remain active. In this direction, there is urgent need to take a more aggressive approach in managing the available data, production, compilation, and evaluation of new databases and effective use of computer networks for transmission of these databases to interested researchers all over the world. A trinity symbiotic relationship is proposed here comprising of data needs from the industry, a support base for small research groups (e.g. research laboratories at universities) and a reliable continuous research system. It is only when all the three branches of this trinity effectively correlate with each other that this roadmap will be fully realized.

### References

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