

Fujimoto, T. (Dept. Eng. Phys. and Mech. Kyoto Univ.)

Sakimoto, K. (Inst. Space and Astr. Sci.)

Takagi, H. (Kitasato Univ.)

Sawada, K. (Shinshu Univ.)

Shimada, M., Shimizu, K. (JAERI)

Kato, T.

In the ITER Project, the divertor is to play an essential role; it should control the density of the core plasma, control the particle transport of neutral species and ions, and should dissipate large amount of energy as radiation from the plasma. The divertor plasma has a wide range of plasma parameters and is highly inhomogeneous. In order to accomplish the above objectives under such a condition, a reliable model should be established for atoms, ions and molecules, which treats the dynamics of these species and would be incorporated with spectroscopic measurements.

For hydrogen atoms, such a model, the collisional-radiative (CR) model, has been established which is highly reliable. For molecular hydrogen, a CR model has been constructed. These models have been successfully applied for determination of atom, molecule and electron densities in the SOL of a tokamak plasma. The latter model, however, is rather limited; it assumes that molecules in the ground and electronically excited states are in the vibrationally ground state. It also lacks the processes starting from the molecular ion state.

Takagi is now completing his calculation of the cross sections concerning the molecular ions: *i. e.*, vibrational excitation, dissociative recombination

and excitation-dissociation. These data are being incorporated into the CR model for molecular hydrogen, and the revised model will be available in near future.

It has been found that the divertor plasma detaches from the divertor plate. This suggests that volume recombination is taking place. The electron temperature as low as 1 eV has been measured in DIII-D. In order to control recombination, the CR model for hydrogen atoms as well as that for molecular hydrogen should be employed. A possibility that the presence of neutral molecular hydrogen enhances recombination through dissociative recombination of molecular ions is proposed. This problem should be settled by an analysis based on the reliable CR model.

For helium atoms, a reliable CR model has been constructed by Goto. It incorporates the best set of cross section data for important transitions. It also includes the singlet-triplet wavefunction mixing and its enhancement by a magnetic field of several tesla. One of the objectives of helium spectroscopy is to determine the ash helium atom density. Emission line intensity depends strongly on the metastable atoms density so that the latter quantity should be understood well. This problem is also concerned with the CR model together with the particle transport.

Helium ion is hydrogenlike and its CR model should be similar to that for neutral hydrogen. A CR model for hydrogenlike ions is present (COLRAD). By using this model, it has been pointed out that the efficiency of dissipation of energy by helium ions is higher than that by neutral hydrogen and helium atoms by two orders of magnitude. This point should be confirmed by an independent model.