



**International Atomic Energy Agency**

# **Atomic and Molecular Unit Review of CRPs**

**R.E.H. Clark  
D. Humbert**

# Recent CRPs

**“Data for Molecular Processes in Edge Plasmas”:** Completed 2005, volume of APID in preparation

**“Atomic and Molecular Data for Fusion Plasma Diagnostics”:** Completed 2005, volume of APID in preparation

**“Tritium inventory in fusion reactors”:** Final RCM September 2006, results to appear in APID, Nuc. Fus.

# Data for Molecular Processes in Edge Plasmas

- **Photoionization cross sections for simple hydrocarbons**
- **Cross sections for excitation, ionization for H<sub>2</sub> and selected hydrocarbons**
- **Temperature dependence of appearance energies measured**
- **Charge transfer cross sections for selected molecules**

# Data for Molecular Processes in Edge Plasmas

- Data for hydrogen molecules and isotopemers completed and used in model, effective rate coefficients calculated
- Excitation, de-excitation, elastic cross sections for hydrogen and isotopemers calculated
- Ion survival probabilities, energy transfer, dissociations and chemical reactions for hydrocarbon ions (C1-C3) with carbon surfaces completed

# Atomic and Molecular Data for Fusion Plasma Diagnostics

- **Data for application to spectral observations near the strike zone and divertor were measured and calculated;**
- **Data for helium beam diagnostics from fast to thermal have been generated;**
- **large amounts of data on spectral properties were generated;**
- **X-ray emissions from impact on surfaces have been addressed;**
- **Data were generated for use in hydrogen charge exchange spectroscopy.**

# Tritium Inventory in Fusion Reactors

- **Focus more R&D on effectiveness of tritium removal techniques from Be and BeO co-deposits with carbon and tungsten impurities.**
- **Need capability in the design to change materials in first wall, due to concern of unacceptable high tritium inventories with current PFC materials.**
- **ITER should explore the possibility of using high (400 C or more) temperature for tritium removal and for reduction of tritium inventory.**
- **Design a cooled (room temperature) co-deposit collector in the divertor, which is heatable (to >700C) for subsequent hydrogen release and removal.**

# Current CRPs

**“Atomic and Molecular Data for Plasma Modelling”**: Initiated 2005, 1<sup>st</sup> RCM  
September 2005

**“Atomic data for high Z element impurities in fusion reactors”**: Initiated 2005, 1<sup>st</sup>  
RCM November 2005

# Atomic and Molecular Data for Plasma Modelling

- **First RCM 2005, Summary report available online**
- **Detailed work plan formulated, surface and volume processes to be considered**
- **Focus on gathering and generating new data relevant to modeling the edge region of plasmas relevant to nuclear fusion energy devices**
- **Participants note a good match between this CRP's expertise and the identified needs in this area**
- **Second RCM planned for spring 2007**

# Atomic and Molecular Data for Plasma Modelling Participants

- Z. Herman, Czech Republic
- K. Hassouni, France
- D. Reiter, Germany
- M. Capitelli, Italy
- M. Kimura, Japan
- H. Tanaka, Japan
- R. Janev, Macedonia
- S. Matejcik, Slovak Republic
- M. Larsson, Sweden
- J. Tennyson, UK
- B. Braams, USA
- J. Hogan, USA

# **Atomic data for high Z element impurities in fusion reactors**

- **First RCM 2005, Summary report available online**
- **Participants reviewed current research capabilities**
- **Current data needs for heavy elements reviewed**
- **Detailed work plan formulated, specifying important processes to be considered, desired accuracy etc.**
- **Second RCM planned for 2007**

# Atomic data for high Z element impurities in fusion reactors Participants

- I. Bray, Australia
- Luo Zhengming, China
- M. Cornille, France
- K. Katsonis, France
- A. Müller, Germany
- T. Kato, Japan
- V. Nikulin, Russia
- M. Trzhaskovskaya, Russia
- M. O'Mullane, UK
- J. Colgan, USA
- E. Den Hartog, USA
- W. Wiese, USA

# Future

**New for 2006: “Data for surface composition dynamics relevant to erosion processes ” in process, first RCM to be held 2007**

**New for 2008-9: To be determined, topics to include dust formation, burning plasma issues**