Review of CRP and Meeting Objectives

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First Research Coordination Meeting of IAEA Coordinated Research Project on Plasma-Wall Interaction for Irradiated Tungsten and Tungsten Alloys in Fusion Devices
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Nuclear Data Section CRPs

For example:
- CRP F44003 on Primary Radiation Damage Cross Sections. Determine ways to characterize radiation damage beyond the NRT dpa standard.
- CRP F43020 on Data for Erosion and Tritium Retention in Beryllium Plasma-Facing Materials. Experiments and modelling for the JET and ITER main wall material.
- CRP F44002 on Nuclear Data Libraries for Advanced Systems: Fusion Devices (FENDL-3). Update the Fusion Evaluated Nuclear Data Library to support fusion reactor development and IFMIF.

In general:
- Usual aim is to produce data for some well-defined class of processes.
- Normally 8-14 participating projects.
- Normally 3 Research Coordination Meetings over the course of 3-4 years.
- An INDC (NDS) meeting report is produced for each RCM.
- Final report is often a data document, IAEA Tecdoc, but can be different.

CRP Research Objectives

Broad objective: to understand how tritium retention, tritium migration and ways to extract trapped tritium are affected by radiation damage.
- Effects of neutron irradiation and charged particle surrogate irradiation on the microstructure of tungsten-based plasma-facing materials.
- Relation between tungsten microstructure after irradiation and properties of tritium retention and tritium migration.
- Goal for the end of the CRP: Synthesize new information, extrapolate to relevant fusion neutron flux, and provide best expert estimates and uncertainties for properties of tritium retention and tritium transport for tungsten-based materials in a fusion reactor environment.
- Central concept: Irradiated tungsten microstructure.
  - How to characterize microstructure (in experiment and in a database)?
  - Study production and evolution of vacancies, interstitials, Frenkel pairs, line and plane dislocations, bubbles, grain boundaries, amorphization, …, as a function of mode of irradiation.
  - How does tritium trapping and tritium migration depend on microstructure?
- The CRP requires strong coupling between experiment and computation.

Knowledge Base option

We maintain a Wiki-style knowledge base on plasma-material interaction data. It is a resource for locating such data and for supporting information.

Database options and objectives

NDS and A+M Data Unit maintains databases on plasma-material interaction: see https://www-amdis.iaea.org/ALADDIN. Some of the output of the CRP may be suitable for a database. However, we have no data in ALADDIN at this time on microstructure or effects of irradiation or hydrogen transport in material, and we don’t know a good structure for it either. This for discussion.

Objectives for the First RCM

Exchange information about ongoing work:
- 19 participants, 19 major active research projects.
- Experiments on damage production, hydrogen exposure.
- Applied and fundamental modelling.
- Review work that is most needed next 1-5 years.
- Experiments and modelling to improve understanding of damage production; neutron and surrogate irradiation.
- Experiments and modelling to improve understanding of hydrogen in damaged tungsten, as it depends on the microstructure.
- Fundamental (QM) modelling to support applied (MD, KMC) work.
- Make plans for cooperation; exchange of information between RCM.

CRP on Irradiated Tungsten

Full title: Plasma-Wall Interaction for Irradiated Tungsten and Tungsten Alloys in Fusion Devices.
But really… Tritium Retention in Irradiated Tungsten.

Main topics:
- Characterization of microstructure of irradiated tungsten;
- Hydrogen trapping and migration in damaged tungsten.

Main objective for the end of the CRP:
- To provide best expert estimates and uncertainties for tritium retention in tungsten-based materials in a fusion reactor environment.

Very much interest: 19 participating projects, many of them multi-institute teams; all fusion parties well represented.

Expected schedule:
- First Research Coordination Meetings (RCM) 26-28 Nov 2013.

Other activities are possible, e.g. in connection with PSI or PFMC meeting.
Meeting schedule

Tuesday + Wednesday: Presentations. 19 CRP participants and ITER.
Thursday: Review and discussion sessions towards work plan:
   1. Production and characterization of damage; experiments and supporting modelling.
   2. Hydrogen (tritium) retention and transport in damaged tungsten; experiments and supporting modelling.
   3. Fundamental modelling and its connection to experiments and applied modelling.
   4. Review of expected outputs of the CRP and of individual contributions; plans for coordinated work.

Following the meeting: Production of the meeting report, INDC(NDS) series.
Presentation summaries are requested from all participants. I ask for volunteer help for the summaries of Items 1-3 in Thursday’s discussion.

Next likely interaction: 21st PSI (Kanazawa, 26-30 May 2014) and 12th Hydrogen Workshop (Toyama, 2-4 June 2014). Consider some joint contributions.

... Thank you and let the science begin ...