

Review of CRP and Meeting Objectives

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First Research Coordination Meeting of IAEA Coordinated Research Project

*Plasma-wall Interaction with Reduced-activation Steel Surfaces
in Fusion Devices*

IAEA, Vienna, 09-11 December 2015



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Article III of the IAEA's statute mandates that the IAEA should encourage and assist research on and development and practical application of atomic energy and its applications for peaceful purposes throughout the world and foster the exchange of scientific and technical information and exchange of scientists for peaceful uses of atomic energy. The **IAEA's Coordinated Research Activities (CRAs)** have been designed to contribute to the fulfilment of this mandate by stimulating and coordinating the undertaking of research by institutes in IAEA Member States in fields in selected nuclear fields.

 [Proposal Forms](#)



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. Data for JET and ITER main wall material.
- CRP F44021 on Plasma-Wall Interaction with Irradiated Tungsten and Tungsten Alloys in Fusion Devices. Theory and modelling devoted mainly to issues of tritium retention and migration in irradiated tungsten.

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 3-4 years.
- An INDC (NDS) meeting report is produced for each RCM.
- Final report may be a data document, IAEA Tecdoc, but can be different.

CRP on Steel Surfaces

Full title: Plasma-wall Interaction with Reduced-activation Steel Surfaces in Fusion Devices.

Main topics:

- Differential erosion of steel surfaces by exposure to fusion plasma.
- Composition and microstructure of exposed steels.
- Tritium retention and tritium migration in RAFM steels.
- Effects of neutron irradiation and energetic particles.

Schedule:

- First Research Coordination Meeting (RCM) 09-11 December 2015.
- 2nd RCM Q2 2017, 3rd RCM in about Q4 2018.
- Final report developed in 2019.

Other activities: can be considered in connection with PSI or PFMC.

CRP Research Objectives

Broad objective: Enhance the knowledge base on erosion, tritium deposition and tritium migration processes involving fusion relevant (reduced activation, RAFM) steel surfaces.

Specific objectives:

- Characterize the composition and microstructure of (reduced activation, RAFM) steel surfaces after differential erosion by exposure to fusion plasma.
- Characterize plasma-material interaction properties for erosion, tritium retention and tritium migration in steels surfaces that are exposed to fusion plasma.
- Investigate ways to mitigate tritium penetration and tritium retention in steel surfaces and to extract trapped tritium.

Goal for the end of the CRP: Increased confidence in assessments of the role of steel as plasma-facing material in DEMO or a Fusion Power Plant.

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. This for discussion.

Go to data selection

Filter from selection

Reset request

Process

Reflection
Chemical Sputtering
Physical Sputtering
Radiation Enhanced Sublimation
Penetration

Projectile

H
D
T
[3]He

Surface

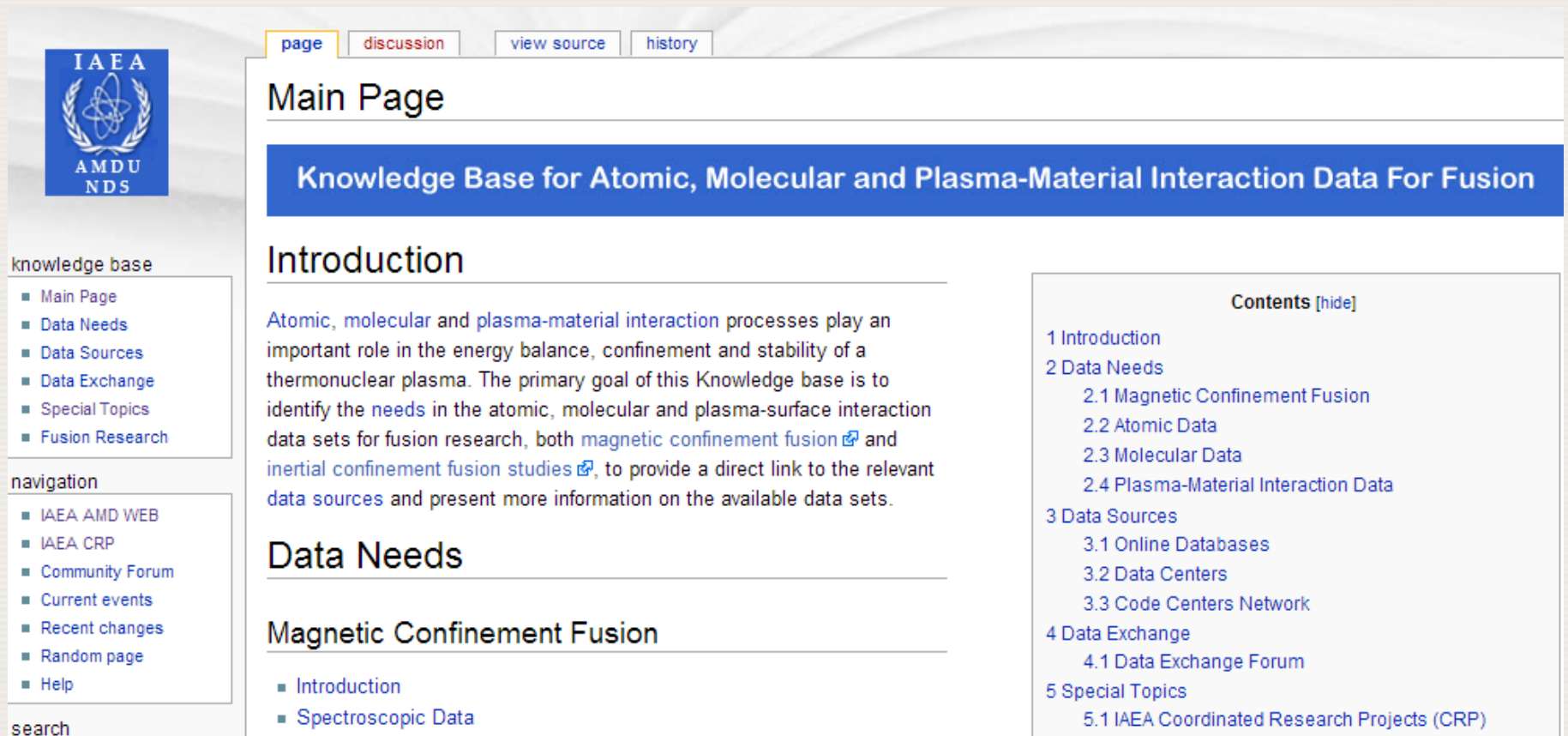
Be
Graphite
a-Carbon
CFC

Chemical Component

Be
C
W
H

Knowledge Base option

We maintain a Wiki-style knowledge base, <https://www-amdis.iaea.org/w/>, for information about atomic, molecular and plasma-material interaction data. It is a resource for locating such data and for supporting information.



The screenshot shows the main page of the IAEA AMDU NDS Knowledge Base. At the top left is the IAEA logo with 'AMDU NDS' below it. To the right are navigation tabs for 'page', 'discussion', 'view source', and 'history'. Below the tabs is a blue banner with the text 'Knowledge Base for Atomic, Molecular and Plasma-Material Interaction Data For Fusion'. The main content area is titled 'Introduction' and contains a paragraph about the importance of atomic, molecular, and plasma-material interaction processes in fusion research. To the right of the main text is a 'Contents' table of contents. On the left side, there are two vertical menus: 'knowledge base' and 'navigation', each containing a list of links. At the bottom left is a search bar.

IAEA
AMDU
NDS

page discussion view source history

Main Page

Knowledge Base for Atomic, Molecular and Plasma-Material Interaction Data For Fusion

Introduction

Atomic, molecular and plasma-material interaction processes play an important role in the energy balance, confinement and stability of a thermonuclear plasma. The primary goal of this Knowledge base is to identify the needs in the atomic, molecular and plasma-surface interaction data sets for fusion research, both [magnetic confinement fusion](#) and [inertial confinement fusion studies](#), to provide a direct link to the relevant [data sources](#) and present more information on the available data sets.

Data Needs

Magnetic Confinement Fusion

- Introduction
- Spectroscopic Data

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knowledge base

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navigation

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Objectives for the First RCM

Exchange information about ongoing work.

- 7 active research projects.
- Experiments on erosion, hydrogen exposure.
- Applied and fundamental modelling.

Review work that is most needed next 3-5 years.

- Experiments and modelling to improve understanding of differential erosion of (reduced activation, RAFM) steels.
- Experiments and modelling of hydrogen retention and migration in RAFM steels.
- Fundamental (QM) modelling to support applied (MD, KMC) work.

Review and coordinate work plans.

- Each participant to review work plan for next 1-3 years in light of all the work in the CRP.
- Make plans for cooperation; exchange of information between RCM.

Meeting schedule

Wednesday + Thursday am: Presentations.

Thursday pm + Friday: Review and discussion sessions; work plan:

1. Erosion and material evolution.
2. Hydrogen isotope retention and transport in RAFM steel.
3. Relations between fundamental and applied modelling and experiments.
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 will ask for volunteer help for the discussion summaries.

Next likely interaction: 22nd PSI (Rome, 30 May – 03 Jun 2016) and 13th Hydrogen Workshop (Milan, 06-08 Jun 2016).

... Thank you ...