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| **WPPWIE Deliverables Status Report** | | | | | **Date:** | | | 01-Sep-2022 | | |
| **Subproject:** | SP C / Retention and Release | | | | **Deliverable ID** | | | PWIE-SP C.3.T-T002-D002/D003/D004 | | |
| **Deliverable owner:** | J. Zavaznik / S. Markelj / V. Nemanic (JSI) | | | | **Deliverable due date** | | | 31-12-2022 | | |
| **WP Leader:**  **SP Coordinator:** | S. Brezinsek (FZJ)  K. Schmid (MPG) | | | |  | | |  | | |
| **Task title:** | SP C.3 Influence of He, high-flux D and impurities on Hydrogen retention and transport | | | | | | | | | |
| **Deliverable title:** | JSI: Influence of near surface He implantation and oxide layers on permeation and retention | | | | | | | | | |
| **Status:** |  | **Completed** |  | **Partially completed** | |  | **Delayed** | |  | **Cancelled** |
| Please write a short status report (max. ½ pages) here.  Please check the status of the deliverable(s) with a “x” in the row above.  If the deliverable(s) are delayed, please also indicate an estimated completion date in the report text.  If the deliverable(s) include machine time, please indicate the number of days that have been used for the deliverable(s) in the report text.  For reference, the specification of this task from the PMP is given below. | | | | | | | | | | |
| **Reference from PMP:** | | | | | | | | | | |
| The transport of hydrogen isotopes HIs through the first wall of fusion devices is the driving process for HIs retention but also for permeation to the coolant. Both of these processes have fundamental implications for the safety and the tritium self-sufficiency of a fusion reactor. This requires experiments on HIs retention in the different materials (W, steels and Cu-alloys) due to trapping at intrinsic defects and at defects generated due to exposure to the fusion environment: bombardment by plasma species (HIs and impurities) and accumulation of He due to nuclear reactions. He forms clusters and bubbles in metals which act as strong traps for HIs, and thus can lead to a high Tritium inventory. Experiments on the dependence of He-clustering and bubble formation on the local He amount and temperature history of the material must be performed and the binding energy of HIs to these defects must be measured. Also, synergistic effects due to the simultaneous presence of HIs and He like stabilization of the generated defects need to be investigated. | | | | | | | | | | |
| **Inputs required:**  Facilities: Accelerators | | | | | | | | | | |
| **Tasks to be performed:**   * Study the effect of O or C layers on D: bulk vs surface uptake - from 1 monolayer to a few hundred of nanometers (CEA) * Influence of surface oxide films on the uptake of deuterium into the metallic tungsten in dependence on D ion energy and fluence (MPG) * Influence of surface oxide films on the release of deuterium into the metallic tungsten in dependence on film thickness (MPG) * XRD and Raman of Oxide films on W in cooperation with MPG (JSI, MPG) * Permeation barrier properties of chromia grown on dense Cr films on Eurofer (JSI) * Comparing He cluster nucleation in defect free and e-beam-damaged W (MPG) * E-beam irradiation of single crystal W from MPG (ENEA) * Influence of surface microstructure due to low energy He irradiation on D uptake studied in situ (JSI, MPG)   Self-damaged W samples for JSI investigation (MPG) | | | | | | | | | | |
| **Deliverables:**   |  |  | | --- | --- | | **Deliverable ID** | **Deliverable Title** | | D001 | CEA: Uptake of D through O- and C-layers as function of fluence | | D002 | JSI: Influence of near surface He implantation and oxide layers on permeation and retention | | D003 | JSI: Influence of near surface He implantation and oxide layers on permeation and retention | | D004 | JSI: Influence of near surface He implantation and oxide layers on permeation and retention | | D005 | MPG: Release of D through oxide films from the W bulk as function of D ion energy and fluence. Retention of He in e-beam damaged W. Supply self-damaged W-samples for JSI investigations. | | D006 | MPG: Release of D through oxide films from the W bulk as function of D ion energy and fluence. Retention of He in e-beam damaged W. Supply self-damaged W-samples for JSI investigations. | | D007 | ENEA: e-beam damaged W samples for MPG | | | | | | | | | | | |
| **Management Information**  **Human Resources (2022)**:   |  |  |  |  | | --- | --- | --- | --- | | **Deliverable Owner** | **Beneficiary** | **PM** | **Deliverable (Team)** | | R. Bisson | CEA | 8 | D001 | | J. Zavaznik | JSI | 2 | D002 | | S. Markelj | JSI | 5 | D003 | | V. Nemanic | JSI | 4 | D004 | | T. Schwarz-Selinger | MPG | 5 | D005 | | W. Jacob | MPG | 8 | D006 | | M. Vadrucci | ENEA | 3 | D007 | | **Total** |  | 35 |  |   **Machine Resources (2022):**   |  |  |  |  | | --- | --- | --- | --- | | **Device** | **Beneficiary** | **Days** | **Related Deliverable** | | Accelerator | MPG | 25 | D003 | | Accelerator | JSI | 8 | D002 |   **Other resources:**    **Collaborations:**  **Other information:**  Connected to TSVVs associated with WPPWIE | | | | | | | | | | |