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| **WPPWIE Deliverables Status Report** | | | | | **Date:** | | | 01-Sep-2022 | | |
| **Subproject:** | SP C / Retention and Release | | | | **Deliverable ID** | | | PWIE-SP C.2.T-T002-D001 | | |
| **Deliverable owner:** | Y. Ferro (CEA) | | | | **Deliverable due date** | | | 31-12-2022 | | |
| **WP Leader:**  **SP Coordinator:** | S. Brezinsek (FZJ)  K. Schmid (MPG) | | | |  | | |  | | |
| **Task title:** | SP C.2 Modelling of Hydrogen Transport properties in the first wall | | | | | | | | | |
| **Deliverable title:** | Energy landscape of H at a W/Cu material interface (CEA) | | | | | | | | | |
| **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. The first wall of a future fusion reactor will be comprised of the top armor material W and structural materials below like steel or Cu alloys that connect the top plasma-facing surface to the coolant. Modeling this transport is multi-scale problem that requires both macroscopic rate equation models like Diffusion Trapping Codes (DTCs) and atomistic models like Density Functional Theory (DFT). The DFT codes model the energy landscapes around lattice imperfections, which then yield the activation energies and attempt frequencies for the DTCs that can then model the transport within an entire first wall component on realistic time scales. The macroscopy rate equation models need to able to handle the interfaces between different wall materials, temperature gradients and appropriate boundary conditions on the plasma and coolant water side to describe the entry of HIs into and out of the first wall. To model the retention in the material the codes have to contain models that describe the defect evolution due to interaction of the first wall with the fusion environment: bombardment by plasma species and/or MeV neutrons, formation of transmutation and decay products like e.g. Re and He. | | | | | | | | | | |
| **Inputs required:**  Experimental data from permeation and retention experiments | | | | | | | | | | |
| **Tasks to be performed:**   * H diffusion and segregation at the Cu/W interface (CEA)   DFT calculations of defects in W in the presence of H and He (UKAEA) | | | | | | | | | | |
| **Deliverables :**   |  |  | | --- | --- | | **Deliverable ID** | **Deliverable Title** | | D001 | Energy landscape of H at a W/Cu material interface (CEA) | | D002 | Formation of Defects in the presence of H and/or He | | | | | | | | | | | |
| **Management Information**  **Human Resources (2022)**:   |  |  |  |  | | --- | --- | --- | --- | | **Deliverable Owner** | **Beneficiary** | **PM** | **Deliverable (Team)** | | Y. Ferro | CEA | 9 | D001 | | M. Lavrentiev | UKAEA\* | 6 | D002 | | **Total** |  | 15 |  |   \* only when UKAEA participates in EUROfusion  **Hardware/ Machine Resources:**   |  |  |  |  | | --- | --- | --- | --- | | **Device** | **Beneficiary** | **Days** | **Related Deliverable** | | **n.a.** |  |  |  |   **Other resources:**  **Collaborations:**  **Other information:**  Connected to TSVVs associated with WPPWIE | | | | | | | | | | |