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| **WPPWIE Deliverables Status Report** | | | | | **Date:** | | | 01-Aug-2022 | | |
| **Subproject:** | SPA / Particle & Heat Load Studies in preparation of the exploitation of ITER and DEMO | | | | **Deliverable ID** | | | PWIE-SP A.1.T-T002-D001 | | |
| **Deliverable owner:** | M. Wirtz | | | | **Deliverable due date** | | | 31-12-2022 | | |
| **WP Leader:**  **SP Coordinator:** | S. Brezinsek (FZJ)  J.W. Coenen (FZJ) | | | |  | | |  | | |
| **Task title:** | SP A.1 Synergistic Load Studies of Plasma-Facing Materials for ITER & DEMO | | | | | | | | | |
| **Deliverable title:** | Damage threshold for different W materials at varying loading conditions in matrix form / Understanding the damage mechanisms and changes in material properties and changes in the retention behavior (FZJ) | | | | | | | | | |
| **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:** | | | | | | | | | | |
| This task contributes to the qualification of current baseline materials and beyond by different heat load treatment techniques and quantifying the difference in damage behavior by the different loading techniques as well as the additional impact of fuel species and other fusion relevant conditions. In addition, it helps with the long-term activities in the FSD and FTD to predict the power load capabilities and damage thresholds for materials envisioned for current and future fusion devices.  This includes the qualification of materials for W7-X (in collaboration with WPDIV and WPW7X) and preparation of exposures in WEST and ASDEX Upgrade (via WPTE). The basis for the tests are materials defined by WPMAT and WPDIV. ITER as baseline for the use in current devices as well as DEMO.  Link with activities related to neutron testing when appropriate combine with plasma loading e.g. JULE-PSI. | | | | | | | | | | |
| **Inputs required:**   * Materials provided by the parties in-line with Tasks * Heat-flux profiles and specifications from ITER/W7-X/WEST * Thermomechanical properties where available * Samples from pre-damaged experiments in WEST / DEMO limiter samples (WPDIV) / Composite and Alloy Samples (WPPRD) | | | | | | | | | | |
| **Tasks to be performed:**   * Establish a test matrix for Materials utilized in WEST and ITER with respect to updated load specifications. in the available devices (DIFFER, FZJ, MPG) * Study the impact of synergistic loads on ITER and DEMO relevant baseline Materials (tungsten) and new materials developments with Laser (Laser at PSI-2) and e-beam (JUDITH) as well as steady-state plasma exposure (He, H). A special focus will be the qualification of these materials under high cycle numbers and seed-impurities exposure. (FZJ) * Post-mortem analysis will characterize the induced surface modifications and damages as well as investigate changes of the materials properties due to e.g. recrystallization behavior and/or surface morphology changes (FZJ, MPG, DIFFER, KIPT) * Determine underlying mechanisms of evolution of crack propagation in materials for ITER and current day devices (FZJ, DIFFER, KIPT, MPG) * Qualify W materials for use in W7-X (MPG, FZJ) * Synergy effects from sequential stationary (PSI-2 / MAGNUM-PSI) and transient (QSPA) plasma loads. (DIFFER, MPG, FZJ, KIPT) * Studies of fatigue cracks formation in deformed/re-crystalized W, fatigue damage of Wf/W wires, latticing W etc. * Combination of pulsed and steady state loading (e.g. behaviour of QSPA pre-damaged targets in PSI-2, JUIDTH compared with reference samples) (FZJ, KIPT) * Study the Behavior of pre-cracked samples under edge loading conditions - links to HHF facilities such as JUDITH and WEST (DIFFER, FZJ) | | | | | | | | | | |
| **Deliverables:**   |  |  | | --- | --- | | **Deliverable ID** | **Deliverable Title** | | D001 | Damage threshold for different W materials at varying loading conditions in matrix form / Understanding the damage mechanisms and changes in material properties and changes in the retention behavior (FZJ) | | D002 | Pre-crack damage evolution and erosion under transient loading (DIFFER) | | D003 | Qualification of OLMAT as HHF facility in comparison with QSPA and GLADIS (CIEMAT) | | D004 | Qualification of W-Heavy Alloys for use in W7-X in conjunction with test on new tungsten mock-ups (WPMAT) and PFUs for WEST (WPTE) (MPG) | | D005 | Qualification of current baseline materials under transient (HHF plasma load with QSPA) and steady state loading (PSI-2, JUDITH) (KIPT) | | | | | | | | | | | |
| **Management Information**  **Human Resources (2022)**:   |  |  |  |  | | --- | --- | --- | --- | | **Deliverable Owner** | **Beneficiary** | **PM** | **Deliverable (Team)** | | M. Wirtz | FZJ | 9 | D001 (T. Loewenhoff, M. Gago, D. Dorow-Gerspach\*) | | T. Morgan | DIFFER | 4 | D002 | | P. Tabares | CIEMAT | 3 | D003 | | H. Greuner | MPG | 2,5 | D004 (H. Greuner, H. Maier, M. Balden) | | I. Garkusha | KIPT | 30 | D005 | | **Total** |  | 48.5 |  |   **Machine Resources (2022):**   |  |  |  |  | | --- | --- | --- | --- | | **Device** | **Beneficiary** | **Days** | **Related Deliverable** | | PSI-2 | FZJ | 14 | D001 | | JUDITH | FZJ | 10 | D001 | | GLADIS | MPG | 4 | D004 | | MAGNUM-PSI | DIFFER | 5 | D002 | | QSPA | KIPT | 10 | D005 | | OLMAT | CIEMAT | 4 | D003 |   **Other resources:**  **Collaborations:**   * WPDIV, WPMAT, WPPRD in FTD * WPTE, WPW7X in FSD * IO and ITPA DivSOL   **Other information:**   * Connected to TSVVs associated with WPPWIE * \*ENR from mid-2021 on | | | | | | | | | | |