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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.3.T-T002-D001 | | |
| **Deliverable owner:** | J. Coenen | | | | **Deliverable due date** | | | 31-12-2022 | | |
| **WP Leader:**  **SP Coordinator:** | S. Brezinsek (FZJ)  J.W. Coenen (FZJ) | | | |  | | |  | | |
| **Task title:** | SP A.3 / Advanced Materials under thermo-mechanical and plasma loads | | | | | | | | | |
| **Deliverable title:** | Analysis of Material behavior e.g. (Wf/W) under Plasma and heat loading regarding mechanical properties e.g. cracking, embrittlement, and microstructure. Link to SP A4 (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:** | | | | | | | | | | |
| Develop qualification methods for advanced materials for ITER & beyond by different thermos-mechanical test procedures, heat load treatment techniques, and laboratory experiments as well as linear plasma devices.  Apply advanced test and characterization techniques to validate advanced materials for PFC use.  Contribute to long-term activities in WPPWIE to mitigate limitations in PFCs currently available.  Materials from WPMAT and especially WPPRD that are envisioned for use in future relevant exposures e.g. DEMO Divertor / 1st Wall are studied.  Link with activities related to neutron / proton exposure / self- damage testing when appropriate in a combination with plasma loading e.g. JULE-PSI.  Where appropriate, the manufacture of new and advanced materials can be funded in order to facilitate the link with WPMAT and existing advanced materials for use in DEMO and W7-X. | | | | | | | | | | |
| **Inputs required:**   * Advanced materials provided from WPMAT and WPPRD * Materials for the DEMO limiter via WPDIV * PWI / HHF parameters necessary for extrapolation to DEMO * Samples from WPTE/WPDIV/WPPRD | | | | | | | | | | |
| **Tasks to be performed:**   * Plasma qualification of new materials (WPMAT) and components (WPDIV) for DEMO: Thermal shock and plasma synergistic loading of advanced material including exposures in Magnum-PSI (KIPT, DIFFER, FZJ) * Exposure of advanced materials e.g. Wf/W (WPPRD), SMART alloys (WPMAT), additively manufactured components (WPDIV) and others to heat loads and/or plasma loads for assessment of their PWI properties and exploration of limits of their application (FZJ, MPG) * Study of basic thermo-mechanical properties for advanced materials for divertor applications including reference material properties for comparison with neutron-irradiated sample in future (LPP-ERM/KMS, MPG)   + Establish experimental techniques   + Mechanical testing of W-yarns up to very high temperatures, subsequent microstructural characterization (link to neutron irradiation of W yearns & subsequent mechanical testing) (SCK-CEN as part of RU LPP-ERM/KMS)   + Establish experimental basis by e.g. self or proton damage (MPG, FZJ)   + Effect of fusion environment on the mechanical properties of W wire (MPG) * Exposure in plasma devices to study the interplay of recovery, recrystallization, plasma and ELM-like loading on surface cracking and fatigue lifetime (FZJ, KIPT, DIFFER) * Post-mortem analysis to characterize the induced surface and microstructure modifications as well as changes of the materials properties due to e.g. recrystallization behavior and/or surface morphology changes (FZJ, MPG) | | | | | | | | | | |
| **Deliverables:**   |  |  | | --- | --- | | **Deliverable ID** | **Deliverable Title** | | D001 | Analysis of Material behavior e.g. (Wf/W) under Plasma and heat loading regarding mechanical properties e.g. cracking, embrittlement, and microstructure. Link to SP A4 (FZJ) | | D002 | Performance of advanced materials under high heat loads and their microstructural characterization (MPG) | | D003 | Results from tests of small-scale samples of W and other advanced materials and components (LPP-ERM/KMS) | | D004 | Investigation of advanced materials under ELM-like/disruption transient loading and subsequent analysis (KIPT) | | D005 | Exposure of advanced materials in Magnum-PSI and subsequent analysis including thermal shock response of CVD-W to pulsed plasma (DIFFER) | | D006 | Effect of energetic ion irradiation on the strength of W wire (MPG) | | | | | | | | | | | |
| **Management Information**  **Human Resources (2022)**:   |  |  |  |  | | --- | --- | --- | --- | | **Deliverable Owner** | **Beneficiary** | **PM** | **Deliverable (Team)** | | J.W. Coenen | FZJ | 8 | D001 (M. Wirtz, J.W. Coenen, A. Litnovsky) | | T. Morgan | DIFFER | 3 | D005 | | I. Garkusha | KIPT | 15 | D004 | | D. Terentyev | LPP-ERM/KMS | 4 | D003 | | J. Riesch | MPG | 2.5 | D002, D006 (B. Curzadd, S. Elgeti) | | **Total** |  | 32.5 |  |   **Machine Resources (2022):**   |  |  |  |  | | --- | --- | --- | --- | | **Device** | **Beneficiary** | **Days** | **Related Deliverable** | | PSI-2 | FZJ | 11 | D001 | | JUDITH | FZJ | 10 | D001 | | GLADIS | MPG | 4 | D002, D003, D006 | | Accelerator | MPG | 10 | D002, D003, D006 | | QSPA | KIPT | 5 | D004 | | MAGNUM-PSI | DIFFER | 5 | D005 |   **Other resources:**   * Use of irradiation facilities in LPP-ERM/KMS with 10k€ support in 2022 (LPP-ERM/KMS)   **Collaborations:**   * WPDIV, WPMAT, WPPRD in FTD   **Other information:**   * Connected to TSVVs associated with WPPWIE | | | | | | | | | | |