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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.4.T-T002-D004 | | |
| **Deliverable owner:** | I. Garkusha | | | | **Deliverable due date** | | | 31-12-2022 | | |
| **WP Leader:**  **SP Coordinator:** | S. Brezinsek (FZJ)  J.W. Coenen (FZJ) | | | |  | | |  | | |
| **Task title:** | SP A.4 / High Temperature performance of Armour Materials: Recrystallization and Melting | | | | | | | | | |
| **Deliverable title:** | Influence of plasma pre irradiation with heat loads near surface recrystallization on surface damaging with heat loads above the melting threshold (KIPT) | | | | | | | | | |
| **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:** | | | | | | | | | | |
| Melting and its effect on plasma performance and PFC lifetime in particular melting under relevant conditions or ITER and DEMO is still a partly unanswered issue. Here both, experiments in controlled environments and dedicated modelling shall be connected, e.g. by the code MEMOS-U.  The lifetime of PFUs for ITER / WEST is crucially linked to operation near and close to the point of recrystallization. Thus, the study of recrystallization in linear plasma devices including the role of the plasma composition shall be further explored.  Analysis of Tokamak exposed / molten, damaged tungsten materials  The issue of disruption loads on 1st wall tungsten-based materials, and Divertor components for ITER and DEMO is currently the limiting factor when talking about a viable fusion power plant. Here, experiments and the link to extraportable modelling needs to be established | | | | | | | | | | |
| **Inputs required:**   * Heat load specifications and experimental or theoretical data necessary to perform analysis and modelling * Materials or monoblocks provided by the parties in line with tasks * Advanced materials and composites where available see SP A3 * Experimental data from WPTE * Materials samples from SP A1 (e.g. recrystallization) | | | | | | | | | | |
| **Tasks to be performed:**   * Characterization of microstructural changes caused by plasma exposure. Tungsten-based material exposed to different plasma conditions will be investigated in terms of mechanical and microstructural depth profiles. Heterogeneities will be traced in hardness and orientation maps and the locally dominating restauration mechanism identified. (DTU) * Tungsten material exposures in the QSPA under giant ELMs or disruptions with pronounced surface melting (KIPT). Characterization of dust in QSPA experiments: size analysis, influence of B field on trajectories. Stick effects at the surface. * Plasma heat loads which causes surface recrystallization and changes in Microstructure and melt threshold (QSPA/PSI-2/GLADIS) (KIPT, CEA, VR) * Assessment of effect of H and He on W recrystallization with links to WP TE (FZJ, DTU, CEA) * Joint activities with WP TE on damaged components (e.g. melting) (VR) * Experiments on Recrystallization in PSI-2 linked with SP A1 (FZJ, DTU) * Development of the MEMOS-U code Comprehensive validation activities. (link with WP TE (WEST, AUG) and SP B) (VR)   + Sensitivity of MEMOS-U to thermionic property uncertainties. Parametric simulation studies with MEMOS-U. Implementation of active cooling. * Link to SP D (Plasma Background) | | | | | | | | | | |
| **Deliverables:**   |  |  | | --- | --- | | **Deliverable ID** | **Deliverable Title** | | D001 | Assessment of hydrogen impact on material properties linked to ITER relevant PFUs (CEA) | | D002 | Annealing of chosen tungsten-based materials and quantification of recrystallization kinetics (DTU) | | D003 | Development and validation of the MEMOS-U code (link with WPTE – WEST/AUG) (VR) | | D004 | Influence of plasma pre irradiation with heat loads near surface recrystallization on surface damaging with heat loads above the melting threshold (KIPT) | | D005 | Analysis for PSI-2 exposed materials, focusing on recrystallization (FZJ) | | | | | | | | | | | |
| **Management Information**  **Human Resources (2022)**:   |  |  |  |  | | --- | --- | --- | --- | | **Deliverable Owner** | **Beneficiary** | **PM** | **Deliverable (Team)** | | M. Richou | CEA | 6 | D001 | | W. Pantleon | DTU | 5 | D002 | | S. Ratynskaia | VR | 7 | D003 (S.Ratynskaia, P.Tolias, L.V. Ignitchouk F. Castello) | | I. Garkusha | KIPT | 15 | D004 | | M. Rasinski | FZJ | 2 | D005 ( M. Rasinski, A. Kreter, M. Vogel) | | **Total** |  | 35 |  |   **Machine Resources (2022):**   |  |  |  |  | | --- | --- | --- | --- | | **Device** | **Beneficiary** | **Days** | **Related Deliverable** | | PSI-2 | FZJ | 5 | D005 | | QSPA | KIPT | 5 | D004 |   **Other resources:**  **Collaborations:**   * IO ITPA DivSOL   **Other information:**   * Connected to TSVVs associated with WPPWIE * Former JSI task D004 in 2021 about TOKES development transferred in 2022 to novel EEG for this topic. Validation or modelling results can be done within SP A. | | | | | | | | | | |