Contribution ID: **36** Type: **Oral (Plenary Session)**

Damages on tungsten plasma facing components after experimental campaigns in WEST

Monday 4 November 2019 11:00 (20 minutes)

Interaction between the tungsten, used as plasma facing material, and the D/He plasma is still under investigation, in particular for the long duration pulses (> 30s) and high heat fluxes (>10MW/m²). One of the main goal of WEST experiment is to study the behavior of an ITER-like divertor in a tokamak environment, and in particular its impact on the operation, for this type of conditions.

During the first phase of WEST operations (2017-2019), the divertor is made of inertial graphite tiles with a thin W coating, except for a dozen of components, all localized on a particular sector. These components, so called Plasma-Facing Unit (PFU) are made of W monoblocks assembled on a CuCrZr tube, and cooled by water. Seven different industrials manufactured the present 14 PFU, which exhibit different options, like sharp or chamfered edge. During the next phase, planned for 2020, the entire divertor will be equipped with 456 PFU, in order to be able to reach the power and duration expectations.

At the end of the last campaign (C3 –early 2019), these PFU have been closely observed, both inside and outside the tokamak. Several type of changes in the plasma-facing surface have been noticed, with different levels of damages. The most visible evolution is the general plasma footprint, due to the erosion / deposition mechanism. In WEST, its pattern is easily noticeable, due to the quite important ripple in the magnetic field.

However, more important damages have also been observed, like crack network and even local melting. Those damages are related to the relative vertical misalignment of the PFU, which has been precisely measured using a robotic arm and reaching 0.8mm. Triangular marks corresponding to optical hot spot (particles passing through the toroidal gaps), with several millimeters long cracks, have also been observed on several locations. Finally, the most impressive damage observed is a several centimeters long melted edge, on a location far from the strike points. This particular melting is attributed to a singular event, like disruption or run-away electron, which occurred near this trailing edge.

In conclusion, it is very noticeable that such damages were observed on the W PFU for the relatively low incident heat flux estimated (less than 3MW/m²). This is largely due to the important misalignment of the PFU. Even if those damages did not impede the last experimental campaign, PFU have been aligned with a tolerance in line with ITER specifications (< 0.3mm) for the next campaign, which will be more struggling in terms of deposited power on the divertor. This will allow to assess the impact of damaged components on advanced plasma mode, i.e. H-mode with ELMs.

Country or International Organization

France

Author: Mr FIRDAOUSS, Mehdi (CEA)

Co-authors: Dr DIEZ, Mathilde (CEA/IRFM); TSITRONE, Emmanuelle (CEA)

Presenter: Mr FIRDAOUSS, Mehdi (CEA)

Session Classification: Plasma Facing Component Design

Track Classification: Plasma Facing Component Materials and Heat Exhaust for Steady State Operation