Contribution ID: **496** Type: **Invited Oral**

Investigation of ITER-grade tungsten under very high heat loads.

Tuesday 6 June 2017 11:00 (20 minutes)

Experiments carried out on advanced large tokamaks showed effective use of tungsten for making in-Vessel Components, interacting with the plasma. However, in reactor size fusion devices such as ITER and DEMO, are expected the critical loads on the divertor plates both in quasistationary stage and in pulsed events (disruption, VDE, ELMs et al.), High heat loads can cause not only increased erosion and destruction of material surface, but also strong absorption of tritium in erosion products. Usually, it's difficult to obtain divertor ITER-like power load in advance fusion devices with magnetic confinement. Therefore, to simulate ITER conditions powerful e-beam try to use, but it can't replace the real simulation by plasma. As example, JET and ASDEX-U experiments with movement of the molten W droplet, can be explained by electron emission from this droplet in the magnetic field.

On T-10 tokamak with a powerful ECR heating, were obtain regimes with nonambipolar energy flow on tungsten tiles of circular toroidal limiter. ITER-grade tungsten was use, which is intend for the ITER Dome divertor, manufactured by RFDA. The interiors of the limiter are heated to temperature exceed of 2000 0C and estimated heating power is more than 10 MW/m2. Spectroscopic line WI near this plates show exponential increasing, but total radiation power decrease from 50% to 15%, and radiation loss at the boundary increase 3-4 time.

In this regime, there were deep and long cracks and powerful arcing occurred on W tiles. At that, cracks in ion side are perpendicular to tile edges and parallel to each other, as threads. The area of cracks coincide with the area of arcing. The edges of the cracks were melt and arc craters have been scattered not only across the surface but located along the cracks. All tiles surface was cover by resolidificated tungsten, on which there were many arc microcraters.

The report discuss the nonambipolar mechanism of energy flow on metal surfaces, leading to self-heating in the presence of arcs, the ecton mechanism of arcing, mechanism of cracking and estimation of tritium absorption in such kind of cracking.

Eligible for student paper award?

No

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Session Classification: T.OA2: Divertors and PFCs: Tungsten

Track Classification: Divertors and high heat flux components