Contribution ID: **251** Type: **Poster**

The dynamic testing and analysis of copper and copper alloy in divertor working temperature range

Monday, 5 June 2017 13:40 (2 hours)

Abstract: Until now, the most advanced mature plasma facing unit (PFU) technology is the ITER W/Cu PFU, which is a monoblock structure composed by tungsten, copper and copper alloy (CuCrZr) as plasma facing material, interlayer and heat sink, respectively. Meanwhile copper and copper alloy play a role of structural materials in the divertor structure, on account of huge electromagnetic (EM) loads which are induced by eddy currents and halo currents in the magnetic field imposed on copper and copper alloy parts. The EM forces would give rise to material high strain rates because it can reach to a very large value. Moreover, sustained so high heat flux from high temperature plasma, temperature distribution of all divertor components is also complicated. In order to investigate the dynamic response of copper and copper alloy in divertors under EM loads, an experiment on CuCrZr used in EAST divertors was carried out employing a Split Hopkinson pressure bar (SHPB). As supplementary, quasi-static compression and tension tests on copper alloy and copper were performed to obtain basic stress-strain relationship using MTS hydro-servo system and DDL50 electronic testing machine separately. The true stress and true strain curves in relation to strain rates or temperatures are derived from above experiments, which would provide the necessary theoretical basis for evaluation on the dynamical response, fatigue life and damage evolution to divertor components under EM impact loads.

Eligible for student paper award?

No

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Session Classification: M.POS: Poster Session M

Track Classification: Materials and fabrication