



IAEA FEC 2014

Contribution ID: 235

Type: **Oral**

Melting of Tungsten by ELM Heat Loads in the JET Divertor

Wednesday 15 October 2014 16:40 (20 minutes)

Our priority for the 2013 JET campaigns was to provide relevant data for the ITER decision on whether to initially install a full tungsten divertor rather than a design with carbon at the strike points. A key element of this was an experiment using a specially modified divertor module which was used to study the characteristics and impact of ELM induced melting of bulk tungsten on JET operation –JET is currently the only machine with ELMs large enough to perform such experiments. A series of discharges at 3MA plasma current and 23MW of input power were used and resulted in parallel power densities of $\sim 3\text{GWm}^{-2}$ during ELMs and $\sim 0.5\text{GWm}^{-2}$ between ELMs. A $\sim 2\text{mm}$ vertical step in a not normally used part of the divertor was exposed to this heat load for up to 1.5s.

Melting was achieved in series of 7 identical discharges and the depth of material moved/removed on each pulse was very reproducible, at least an order of magnitude less than would be expected from bulk tungsten melting and equivalent to $\sim 10\text{microns}$ per ELM. Tungsten droplets formed and migrated along the exposed edge to the private region driven by $j \times B$ forces. The impact on main plasma was negligible with no disruptions. Small spikes in spectroscopic tungsten signals were observed and suggest occasional ejection of droplets with effective radii of at least 80microns .

The JET results provided very positive support for the ITER decision to start with an all W divertor and provide a valuable benchmark for the transient induced melt layer models used by ITER. Significant progress has been made in reproducing the thermal and melt behaviour seen in JET using the MEMOS code.

This work, part-funded by the European Communities under the contract of Association between EURATOM/CCFE was carried out within the framework of the European Fusion Development Agreement. The views and opinions expressed herein do not necessarily reflect those of the European Commission or those of the European Commission or of the ITER Organization. This work was also part-funded by the RCUK Energy Programme under grant EP/I501045.

This work was supported by EURATOM and carried out within the framework of the European Fusion Development Agreement. The views and opinions expressed herein do not necessarily reflect those of the European Commission.

Paper Number

EX/4-1

Country or International Organisation

UK

Author: Mr MATTHEWS, Guy (UK)

Co-authors: Dr BAZYLEV, Boris (Karlsruhe Institute of Technology); Dr ARNOUX, Gilles (CCFE); Dr COENEN, Jan Willem (Forschungszentrum Juelich GmbH); Dr DEJARNAC, Renaud (Institute of Plasma Physics, AS CR v.v.i.,

Prague, Czech Republic); Dr PITTS, Richard (ITER Organisation)

Presenter: Mr MATTHEWS, Guy (UK)

Session Classification: Divertor & SOL Physics