SURFACE COMPOSITION AND MORPHOLOGY CHANGES OF JET TILES UNDER PLASMA INTERACTION

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Plasma interactions with the main chamber of magnetic fusion devices result in net erosion from some areas and net deposition at other locations. However, high energy particle irradiation means that there are continuous erosion and re-deposition processes involved, creating new surface structures. Understanding these processes and the material transport mechanisms are important for predicting the lifetime of components for future devices such as ITER. Although the net deposition can be readily assessed, net erosion and material mixing is difficult to determine. In 2005 marker tiles were mounted in the JET vessel which have a thin tungsten (W) layer deposited on the CFC substrate with a ~10 microns carbon layer on top. By this device it was hoped to determine the areas where some erosion had occurred during JET plasma operations, when the tiles were removed for analysis in 2007.

This paper describes the results from a set of tiles mounted in a poloidal limiter (in Octant 8) at the outer wall of the main chamber; a comparison is made between the data from tiles near the top, middle and bottom of the limiter. A set of ion beam techniques together with secondary ion mass spectrometry and electron microscopy were used to provide a detailed analysis of the tiles. In general, since plasma interaction is strongest near the centre of the limiter where the tile is closest to the boundary of the confined plasma, erosion dominated on the central tiles, with deposition further from the plasma boundary. However, detailed analysis shows behaviour at the surface is rather complex; the advantages of using several analytical techniques and multi-technique modelling are demonstrated.

 # See the Appendix of F. Romanelli et al., Proceedings of the 22nd IAEA Fusion Energy Conference 2008, Geneva, Switzerland