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Detailed Survey of Dust Particles from JET with the ITER Like Wall: Origin, Composition and Internal Structure

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Comprehensive and systematic surveys of dust particles were performed at JET with the ITER-Like Wall (JET-ILW) after two experimental campaigns, ˜19 h of plasma each. Thought the total amounts removed were small (around 1g) the study of dust categories is crucial for ITER because these are unique data from a full metal-wall (beryllium and tungsten) machine. The identification of various categories of particles allows conclusions on mechanisms underlying their generation and mobilisation. This work deals with dust collected with sticky pads from the divertor tiles and, with metal splashes on erosion-deposition probes in the divertor and the main chamber wall. The local sampling is essential for: (i) finding a correlation between the type of dust and the deposition pattern (ii) comparison of dust identified in a given location after consecutive campaigns
The search has identified several forms. (a) Flakes of Be-rich deposits (up to 800 um) with embedded tiny metal particles: Ni, W. Irregular droplet-like W inclusions, up to 200 nm, are nearly uniformly distributed in the deposit with an exception of the bottom of the layer, i.e. film formed at the early commissioning phase without high power beam operation. There is also a significant content of nitrogen retained after plasma edge cooling. Films are crystalline, but the presence of amorphous regions cannot be fully excluded. (b) Regular Be droplets, diameter 5-10 um and –on probes - Be splashes with small bubbles thus indicating boiling of the droplet. (c) Spherical W droplets, ˜100 um diameter, which could be formed in the experiment on tungsten melting. (d) Droplets of Inconel. (e) Irregular debris or flakes up to 300 um containing W, Mo-W. (f) Ceramics containing boron nitride, zirconium oxide, alumina. In conclusion, the study clearly shows a correlation between the operation mode, material erosion, growth of co-deposits and generation of dust.

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