An insight on beryllium dust sources in the JET ITER-like wall based on numerical simulations

Andrea Uccello, Gabriele Gervasini, Francesco Ghezzi, Enzo Lazzaro, D Borodin, I Borodkina, D Douai, A Huber, I Jepu, D Terranova, A Widdowson and JET Contributors

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Abstract:

After vertical displacement events (VDEs) in the JET-ILW tokamak, debris is produced in liquid form and ejected from the vessels beryllium upper dump plates (UDPs). Most of the droplets splash near the UDPs outboard tile 8 as documented by an in-vessel photographic survey. Moreover, the systematic collection of 'dust' from the main chamber and the divertor region provides evidence of small solid spherical Be particles and flat splats (with fairly circular, 'pancake-like', or elongated shapes) related to melting events (with a diameter of few μm prior the deposition). The migration of metallic Be is studied with the numerical code DUSTTRACK, capable of describing the full droplet dynamics in a non-stationary tokamak plasma configuration. The description of the JET plasma during the VDE proposed here allows for a sufficiently consistent reconstruction of the transient conditions of the background plasma, relying on actual physical measurements. Due to the lack of experimental data related to the initial properties of the ejecta, the statistically relevant sample of 4×105 particles was considered in the DUSTTRACK simulations. A reasonable fit of the initial parameters for the ejected droplets, as well as the time-dependent plasma parameters for the VDE resulted in good qualitative agreement with the post-mortem experimental findings from dust collectors and with the Be deposition pattern near UDPs on the low-field side.