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Data on Runaway Electrons in JET II

The generation of runaway electrons during major disruptions in International Thermonuclear Experimental Reactor is unacceptable. Disruption Mitigation System (DMS) designed in ITER should be a reliable tool for suppression of RE and mitigate other detrimental consequences of disruptions, such as heat and mechanical loads. Elaboration of the RE database and its comprehensive analysis should stimulate further advances in understanding of the physics of RE and their interaction with plasma and neutral gases (fuel and injected impurities, frozen and gaseous) for development of ITER DMS. From the beginning of JET operations there were several attempts to review the data on RE generation events (for example, [1, 2]). However, these attempts are still waiting a compiling into joint database. In previous paper [3] we presented a general summary on RE data in JET, which included general statistics on RE data collected during whole period of JET operations before and after divertor installation. Also dependencies of RE plateau currents on magnetic field and safety factor q95 values during JET disruptions have been studied.
This manuscript presents a recent progress in the development and analysis of the JET RE data. One of the main purposes of this analysis is establishing differences and similarities (phenomenological and numerical) between RE parameters generated during spontaneous or triggered by slow gas injection (GIMs) disruptions, and those RE generated by fast MGI and more recent, Shuttered Pellet Injections (SPI). Such a comparison revealed large variation in RE parameters generated during different type disruptions providing indispensable data for benchmarking of existing models for RE generation and for further simulations of suppression of RE beams using massive impurity injections. The mapping of RE generation parameters on pre-disruption plasma parameters (electron temperature and density) has been carried out in order to study the effects of thermal quench dynamics on expected initial plasma parameters at the beginning of CQ, i.e. to establishing the links between evolution of plasma parameters and plasma geometry during CQ [4], accelerating electric fields and RE generation parameters. Constructed up-to-date the data-base on RE constitutes wide fields of mutual dependencies of plasma and RE parameters. Study of current quench (CQ) stages revealed different, accelerating and constraining effects of initial plasma configurations (circular (limiter) or X-point) on CQ rates, RE generation and value of current conversion ratio (Ipl/IRE).
[1] 1990 Preprint JET-R(90)07, Harris G.R. Comparison of the current decay during carbon-bounded and beryllium-bounded disruptions in JET;
[2] 2006 Nuclear Fusion 46, V.V. Plyusnin et al;
[3] Data on Runaway Electrons in JET. V.V. Plyusnin et al. 46th EPS Conference on Plasma Physics, 2019, Milano, report P4.1046;
[4] 2010 Nuclear Fusion 50, Y. Shibata et al.

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