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EX/P5-01: Wall Conditioning and Density Control in the Reversed Field Pinch RFX-mod

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In the Reversed Field Pinch RFX-mod at the highest plasma current of 2MA, when error fields are not effectively feedback controlled, localized thermal loads up to tenths of MW/m2 can be produced. To withstand such high power loads, the first wall is covered by graphite tiles. As a drawback, due to the high H retention of the graphite, the density control is extremely difficult. Consequently, various wall conditioning techniques have been optimized in the last campaigns and are discussed in the present contribution, including wall lithization and boronization in combination with He Glow Discharge Cleaning (GDC). The cleaning procedure by GDC has been optimized with dedicated experiments, identifying the conditions of better uniformity and effectiveness. Wall boronisation has been carried out by diborane glow discharges of different duration with samples exposed and analyzed to study the uniformity, thickness, erosion and redeposition of Boron. A relevant carbon content has been found in the redeposited layer, consistent with an only halved carbon influx after boronization. Lithium conditioning has been applied; the total amount of evaported Li is about 15g. Main results are: a) with a lithized wall a much better density control is obtained and recycling is lowered; b) impurity influxes do not show significant differences when comparing discharges after GDC wall conditioning and after lithization, consistently with a low impurity content in all conditions; c) at Greenwald fraction less than 0.2 density profiles with lithized wall are more peaked than with carbon wall; d) higher densities up to n/nG ≈ 0.5 can be produced in a controlled way with a lithized wall, but with a very high rate of feeding, resulting in hollow density profiles; e) Li evaporation is effective in covering about one half of the machine surface. In the next future, lithization experiments by a multipellet injector are planned, aiming at a more uniform Li deposition. In summary, lithization has clear operational advantages, but requires long pre-treatments to extract the H saturating the graphite. On this basis, an activity is in progress to study the possibility of changing the present carbon wall with a metallic (W) one.

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