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Anomalous cross-B field transport and spokes in HiPIMS plasma
ANTE HECIMOVIC, CHRISTIAN MASZL, VOLKER SCHULZ-VON DER GATHEN, ACHIM VON KEUDELL, Ruhr University Bochum — The rotation of localised ionisation zones, i.e. spokes, in magnetron discharge is investigated as a function of discharge current, ranging from 10 mA (current density 0.5 mA cm^{-2}) to 140 A (7 A cm^{-2}). The presence of spokes throughout the complete discharge current range indicates that the spokes are an intrinsic property of a magnetron sputtering plasma discharge. Up to discharge currents of several amperes, the spokes rotate in a retrograde ExB direction and beyond the spokes rotate in a ExB direction. In this contribution we present experimental evidence that anomalous diffusion is triggered by the appearance of spokes rotating in the ExB direction. The Hall parameter $\omega_{ce}\tau_c$, product of the electron cyclotron frequency and the classical collision time, reduces from Bohm diffusion values (16 and higher) down to the value of 3 as spokes appear, indicating anomalous cross-B field transport. The ion diffusion coefficients calculated from a sideways image of the spoke is six times higher than Bohm diffusion coefficients, which is consistent with the reduction of the Hall parameter.

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