Abstract

Developing non-inductive startup and efficient fueling techniques is important for the ST and for current-carrying toroidal devices in general. This need is especially acute on the very-low-A Pegasus toroidal experiment due to its limited volt-second capability. Experiments are being conducted to test auxiliary plasma injection and toroidal current drive via DC helicity injection. Dual low-impurity, high-current (1 kA) plasma washer guns[1] have been installed in the lower divertor region of the Pegasus vacuum vessel. These guns act both as helicity and fueling sources. The sources are biased up to –900 V relative to the vessel and initially drive current along helical field lines produced by the toroidal and vertical fields. At high current density, the helical current streams reconnect to form a continuous cylindrical plasma with a net toroidal current. At sufficiently low values of externally applied poloidal field, the toroidal current causes a reversal of the poloidal flux and the plasma relaxes to a tokamak-like configuration. Discharges with toroidal current greater than 25 kA are routinely produced with less than 2 kA of injected current. These high-current plasmas exhibit features indicative of closed flux surfaces, including strong reversal of poloidal flux at the center column, a well-defined edge, significantly increased L/R decay times (> 0.7 ms), observed peaking of the SXR emission at the center of the plasma, significant gas fuelling requirements, and the characteristic n = 1 mode (f=20-60 kHz) which is observed in other helicity-injection-driven toroidal devices. The design of a larger array to be installed in Pegasus next year, projected to provide Ip > 100 kA, is also presented.

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[1] G. Fiksel, A.F. Almagri, D. Craig, M. Lida, S.C. Prager, J.S. Sarff, Plasma Sources Sci. Technol. 5, 78 (1996)