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Attainment of High Electron Poloidal Beta in Axisymmetric State and Two Routes to Self-Organized Helical State in Low-Aspect-Ratio RFP

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Improvement of plasma performance has been advanced in the low-aspect-ratio (low-A) reversed field pinch (RFP) RELAX, whose main objectives include exploring the low-A RFP configuration. In axisymmetric RFP states in deep-reversal region, it is found that central electron poloidal beta, beta_p (=p_e0/(B_paˆ2/(2mu_0))), which almost equals the electron beta in the RFP, has reached to 5˜10%. Feedback control using saddle coil array is applied to stabilize a single resistive wall mode (RWM). As a result, fine tuning of the equilibrium becomes effective in achieving the resultant beta_p of higher than 10%. The attained parameter region is close to where we expect sizable fraction of the bootstrap current which is characteristic to low-A RFP configuration. In shallow-reversal region characterized by relaxation to the quasi-single helicity (QSH) state, soft-X ray (SXR) computed tomography (CT) technique has revealed helically deformed m/n=1/4 structure of SXR emissivity profile. 3-D MHD simulation using the MIPS code has shown two possible routes to the self-organized helical state depending on the initial equilibrium; one through core-resonant tearing mode, and the other through internally non-resonant kink mode. The self-organized helical structure agrees well with experimental results.

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