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Kinking central column and plasma flows generated during coaxial helicity injection current drive in spherical torus TAKASHI KANKI, Japan Coast Guard Academy, MASAYOSHI NAGATA, University of Hyogo, YASUHIRO KAGEI, RIST — MHD relaxation phenomena such as plasmoid ejection, helical kinks, magnetic reconnection, and flows are observed in helicity injection experiments as well as in solar flares and astrophysical jets. Comprehensive understanding of the relaxation mechanism underlying the physics in the helicity injection system is of fundamental importance for both laboratory and space plasmas. The kinking central open column and subsequent plasma flows during coaxial helicity injection current drive in spherical torus are investigated by 3-D nonlinear MHD simulations. Flow plots on the poloidal and toroidal cross sections reveal that as a result of a magnetic reconnection caused by the plasma with the n=1 helical kink distortion, the toroidal flow ($\sim$ 37 km/s) is driven in the opposite direction to toroidal current I_t, but in the same direction as the $\boldsymbol{E}\times\boldsymbol{B}$ plasma rotation induced by an applied voltage. This toroidal reconnection flow expands toward the outboard side and occupies almost the entire toroidal cross section, causing the increase in I_t. In the next stage, the toroidal reconnection flow remains at the inboard, while intense new reversed toroidal flow is induced at the outboard. Then this reversed flow which may be associated with the anti-dynamo effect is enhanced and the toroidal reconnection flow and I_t is gradually suppressed.

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