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Nonlinear MHD simulation of current drive by multi-pulsed coaxial helicity injection in spherical torus TAKASHI KANKI, Japan Coast Guard Academy, MASAYOSHI NAGATA, University of Hyogo, YASUHIRO KAGEI, RIST — The dynamics of structures of magnetic field, current density, and plasma flow generated during multi-pulsed coaxial helicity injection in spherical torus is investigated by 3-D nonlinear MHD simulations. During the driven phase, the flux and current amplifications occur due to the merging and magnetic reconnection between the preexisting plasma in the confinement region and the ejected plasma from the gun region involving the n=1 helical kink distortion of the central open flux column (COFC). Interestingly, the diamagnetic poloidal flow which tends toward the gun region is then observed due to the steep pressure gradients of the COFC generated by ohmic heating through an injection current winding around the inboard field lines, resulting in the formation of the strong poloidal flow shear at the interface between the COFC and the core region. This result is consistent with the flow shear observed in the HIST. During the decay phase, the configuration approaches the axisymmetric MHD equilibrium state without flow because of the dissipation of magnetic fluctuation energy to increase the closed flux surfaces, suggesting the generation of ordered magnetic field structure. The parallel current density λ concentrated in the COFC then diffuses to the core region so as to reduce the gradient in λ, relaxing in the direction of the Taylor state.

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