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Effects of multi-pulsed coaxial helicity injection on dynamics of spherical torus T. KANKI, Japan Coast Guard Academy, M. NAGATA, University of Hyogo, Y. KAGEI, RIST — The mechanism to rebuild the magnetic fields and to amplify the currents in the high-q spherical torus (ST) by the multi-pulsed coaxial helicity injection is investigated using the resistive nonlinear 3D-MHD simulations. During the driven phase, the dynamics is almost axisymmetric because the magnetic fluctuation level of n=0 mode compared with other higher modes is much larger. The toroidal current I_t is effectively amplified due to the merging of plasmoid ejected from the gun region with the pre-existing ST in the confinement region. The poloidal flux is not significantly amplified because the current sheet generated by the merging process does not rapidly decay. The negative toroidal flow v_t is then induced in the direction of I_t around the central open flux column (OFC) region by inductive toroidal electric field E_t(=-$v_z B_r$) because of the plasmoid ejection. The strong poloidal flow v_z (=$E_r B_t$) is also driven from the gun to confinement region due to the Lorentz force. As the result of v_z, the flow vortices associated with the dynamo effect are caused around the upper confinement region. During the decay phase, the closed field lines are regenerated due to the dissipation of magnetic fluctuations. The helical distortion of the OFC becomes small, and then ordered magnetic field structures without flows are built. Just after turning off the external electric field, the poloidal flow from the confinement to gun region is caused by the pressure gradients. The parallel current density λ concentrated in the OFC diffuses to the core region, but does not relax in the direction of the Taylor state due to the pressure gradients.

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