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MHD simulation of relaxation transition to a flipped relaxed state in spherical torus TAKASHI KANKI, Japan Coast Guard Academy, MASAYOSHI NAGATA, University of Hyogo, YASUHIRO KAGEI, RIST — Recently, it has been demonstrated in the HIST device that in spite of the violation of the Kruskal-Shafranov stability condition, a normal spherical torus (ST) plasma has relaxed to a flipped ST state through a transient reversed-field pinch-like state when the vacuum toroidal field is decreased and its direction is reversed [1]. It has been also observed during this relaxation transition process that not only the toroidal field but also the poloidal field reverses polarity spontaneously and that the ion flow velocity is strongly fluctuated and abruptly increased up to > 50 km/s. The purpose of the present study is to investigate the plasma flows and the relevant MHD relaxation phenomena to elucidate this transition mechanism by using three-dimensional MHD simulations [2]. It is found from the numerical results that the magnetic reconnection between the open and closed field lines occurs due to the non-linear growth of the n=1 kink instability of the central open flux, generating the toroidal flow ~ 60 km/s in the direction of the toroidal current. The n=1 kink instability and the plasma flows driven by the magnetic reconnection are consider to be responsible for the self-reversal of the magnetic fields. [1] M. Nagata *el al.*, Phys. Rev. Lett. **90**, 225001 (2003). [2] Y. Kagei *el al.*, Plasma. Phys. Control. Fusion **45**, L17 (2003).

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