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Numerical Simulation of MHD Relaxation during Non-Inductive Startup of Spherical Tokamaks T.M. BIRD, C.R. SOVINEC, D.J. BATTAGLIA, J.B. O'BRYAN, University of Wisconsin-Madison — Nonlinear resistive MHD computation with zero-beta closure is used to investigate the relaxation of helical current filaments into tokamak-like plasmas for non-inductive startup of spherical tokamaks. A localized, volumetric current source has been added to the NIMROD code (nimrodteam.org) to model miniature washer-gun current sources in the lower divertor region of the Pegasus Toroidal Experiment at the Univ. of Wisconsin. When the induced magnetic field is smaller than the vacuum field, a helical filamentary current channel forms on open field lines, comparable to experimental results in similar conditions. Relaxation into tokamak-like plasmas has been demonstrated in experiment with induced fields that exceed the vacuum field [N. W. Eidietis, et al., J. Fusion Energy 26, 43 (2007)], and simulation results in these conditions with comparisons to experiment are presented. We discuss the relaxation process including the roles of diffusion, JxB forces, and magnetic reconnection in the evolution of the magnetic topology.

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