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Nonlinear MHD simulation of DC helicity injection in spherical tokamaks R.A. BAYLISS, C.R. SOVINEC, Univ. of Wisconsin - Madison — 3-D nonlinear MHD computations using the NIMROD code have been performed to study DC helicity injection in the HIT-II and Pegasus spherical tokamaks. Current drive via DC helicity injection has been successfully employed with either a poloidal-gap voltage known as coaxial helicity injection (CHI) [used in HIT-II and NSTX] or a biased miniature plasma gun [used in CDX and Pegasus]. Numerical studies of CHI in a simplified geometry with $\beta = 0$ reproduce the “bubble-burst” formation and the subsequent excitation and saturation (characterized in HIT-II by amplification of poloidal flux) of a line-tied internal kink-mode. The computed strength of saturated fluctuations and poloidal flux are in quantitative agreement with data obtained in the HIT-II experiment. Results from $\beta \neq 0$ simulations with an experimentally accurate geometry will also be presented. Cases driven by a numerical representation of miniature plasma gun self-consistently evolve pressure and anisotropic thermal transport and simulate the formation, merger, and relaxation of the current filaments to a tokamak-like plasma. The results are compared to experimental data from the Pegasus ST. In both injection scenarios the simulations permit a detailed description of the 3-D equilibria exhibited by the helicity-injected driven plasma and reproduce the observations made in the Pegasus ST and HIT-II of amplified poloidal flux and generation of toroidal current.

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