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Two-Fluid Modeling of Current and Flow Relaxation in the Reversed-Field Pinch[1] JOSHUA SAUPPE, CARL SOVINEC, University of Wisconsin-Madison — Reversed-field pinch devices typically exhibit periodic relaxation events that flatten the parallel current profile. These can be explained within the context of resistive magnetohydrodynamics by the MHD dynamo. Including the Hall term in the generalized Ohm's Law gives rise to the Hall dynamo through the correlation of fluctuating magnetic field and current density. This correlation also appears in the ion momentum equation as a Maxwell stress indicating a natural coupling between current and flow relaxation. Previous NIMROD simulations of two-fluid dynamics without background flow demonstrate a relaxation-induced change in flow consistent with experimental observations on the Madison Symmetric Torus [King et. al., Physics of Plasmas Vol. 19 No. 5, 2012]. However the current was parallel to the magnetic field which is opposite to that of the experiment. Simulations with current oriented anti-parallel to the field show a change in flow opposite to that of the previous simulations as the Hall dynamo and Maxwell stress change directions across the plasma. Cases initialized with a background flow profile comparable to MST do not display the same symmetry with respect to the orientation of current, but the net flow relaxation is similar to the cases without background flow.

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