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4P61 - Magnetic Field Diffusion into Al-6061 Rod under Megaampere Current Drive

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The magnetic field diffusion into a conductor driven by intense pulsed power is of interest for current-driven instabilities such as the electrothermal instability (ETI). ETI is thought to develop on the surface of a conductor due to uneven ohmic heating and variation in resistivity that follows the spatial distribution of the current density as impacted by surface roughness and inclusions. The magnetic field also diffuses radially inward to the center of a cylindrical rod in a nonlinear magnetic diffusion wave (NDW)—diffusing more rapidly into the conductor interior because of resistivity increases driven by rising temperatures. The NDW interplays with the inward shock wave caused by the Lorentz force and ejection of low-density material from the conductor surface. The ASC Magnetohydrodynamic (MHD) code FLAG developed by Los Alamos National Lab was used to numerically calculate the radial magnetic field diffusion within an exploding rod, in the skinned current regime, including hydrodynamic effects. A 100-ns, 1-MA current pulse modeled after that from the Zebra pulsed power generator was passed through a 1-mm diameter Al-6061 wire tamped with 70 μm of Teflon. Results were compared with experimental data.

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