Contribution ID: **406** Type: **Poster**

Magnetic Field Diffusion into Hollow Conductors with Walls on the Order of the Skin Depth

Wednesday 21 June 2017 13:30 (1h 30m)

Transient magnetic diffusion through conductors of thickness comparable to the skin depth is investigated. Since an analytical solution is unavailable in this case, such magnetic diffusion results must be determined via simulation or experimentation.

In the experimental approach a sinusoidal current with peak values in the range of 20-30 kA (approx. 7 kHz ringing frequency) is pushed through a two turn coil generating a sinusoidally varying magnetic field. A hollow structure with metallic walls of controlled thickness is placed roughly 10 cm away from the exciting coil. The focus of this investigation is on the transient skin depth, which occurs during the first half-wave of the signal, as that is most relevant for pulsed power applications. A calibrated B-dot probe placed inside the structure facilitates measurement of the diffused field.

Experimental data shows that magnetic field diffusion across the wall is not instantaneous, causing a delay before the diffused field is measured inside the test structure. The impact of cracks and holes in the conductor on the speed and magnitude of the magnetic field diffusion is elucidated. For instance, for a 30 cm long aluminum pipe (3.125 mm wall, 31.25 mm diameter), the addition of a 6.35 mm diameter hole facing the coil did not change the magnitude of the peak of the first half-wave response. However, for the hole oriented ninety degrees away from the coil face, the measured radial dB/dt peak magnitude decreases by a factor of 0.86 from 46.1 to 39.7 mT/s. This unexpected reduction is believed to be due to the superposition of magnetic field diffused through the wall and directly penetrated through the hole. Results for materials of different conductivities are compared and analyzed for the transition between thin and medium walled cases.

Author: BUNTIN, Tyler (Texas Tech University)

Co-authors: COLLIER, Landon (Texas Tech University); DICKENS, James (Texas Tech University); Prof. MANKOWSKI, John (Texas Tech University); NEUBER, Andreas (Texas Tech University); WALTER, John

Presenter: BUNTIN, Tyler (Texas Tech University)

Session Classification: Poster session III - Pulsed Power Physics and Technology, Components and HV Insulation

Track Classification: Pulsed Power Physics and Technology, Components and HV Insulation