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Percolation Studies of Metal-insulator Composites at Microwave Frequencies[1] KELLY MARTIN, JEREMY CARDELLINO, EARNIE JOHNSON, NICHOLAS MISKOVSKY, GARY WEISEL, DARIN ZIMMERMAN, The Pennsylvania State University, Altoona College, JUNKUN MA, Southeastern Louisiana University — We present a systematic study of the effective dc conductivity (σ_{eff}), complex permittivity (ε_{eff}), and complex permeability (μ_{eff}) at microwave frequencies, of metal-insulator mixtures up to and beyond the critical volume fraction (p_c) for conductive percolation. Samples made with varying concentrations of Teflon and micron-sized metallic inclusions of copper, silver, cobalt, and tungsten were subjected to separated microwave electric and magnetic fields of a 2.45 GHz, TM_{010} resonant cavity. Using cavity perturbation techniques, the real and imaginary components of ε_{eff} and μ_{eff} were thus measured at room temperature. We observe the expected strong dependence of σ_{eff}, ε_{eff}, and μ_{eff} on volume fraction near p_c and analyze the results using McLachlan's Generalized Effective Medium (GEM) theory to extract p_c and the percolation exponents s and t.

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