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Electronically tunable metamaterials using subwavelength magnetoresponsive particles[1] MONICA ALLEN, JEFFERY ALLEN, Air Force Research Laboratory, Munitions Directorate, JACOB PARROW, SAJID ASIF, ADNAN IFTIKAR, North Dakota State University, BRETT WENNER, Air Force Research Laboratory, Sensors Directorate, BENJAMIN BRAATEN, North Dakota State University — We demonstrate tunability of material properties of an engineered electromagnetic material in the RF regime using microparticles that respond to static magnetic biasing fields. The magnetic particles align with field lines creating a short/inductive state of the switch in the addressed voxel. When the biasing magnetic field is removed, the switch returns to an open/capacitive state. Each voxel measures 1.5 mm x 1.5 mm x 0.508 mm in the x, y, and z direction respectively, with a 0.9 mm diameter cylindrical cavity. The cavity is along the z-axis and is partially filled with microparticles composed of a magnetite core with Ag coating. Cu foil placed on the top and bottom encloses the particles in the cavity and acts as the biasing electrodes. Switching between inductive and capacitive states in spatially addressed voxels controls the cumulative ε and μ of the host material (i.e., layer) and controls the phase of an incident wave. We present finite element based models of prototype voxels with experimental measurements that validate the models on a host. This research can be applied to real-time tuning of material parameters with subwavelength voxel precision enabling wave control/manipulation as well as devices for switching and software-dictated tunable impedance capabilities.

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