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Electrodeposited NiFe Alloys with High Magnetic Conductivity for Magnetic Flux Channel Antennas

Background Magnetic flux channel (MFC) antennas made of thousands of windings of high magnetic conductivity materials have recently been demonstrated as efficient as conventional antennas, but in a much smaller form factor (D. Auckland, C. Daniel and R. Diaz, "A New Type of Conformal Antenna Using Magnetic Flux Channels", presented at the 2014 Military Communications Conference, Baltimore, Md. in October 2014). The state-of-the-art product used to build the MFC antennas is CoZrNb tape in 12μm-thick polymer tape, which is expensively produced by magnetron sputtering under very delicate control of sputtering temperature, sputtering angle, applied magnetic field, and other conditions. Invention Description To reduce production cost of MFC antennas, researchers at Arizona State University have developed a method for NiFe alloy production via electrodeposition. The electrodeposited NiFe alloy in this invention achieves a peak magnetic conductivity of 6-9M ohms/m, which outperforms high-cost CoZrNb. The plating bath consists of a nickel source, an iron source, a weak acid, an antioxidant, a reducer, and a wetting agent. Any substrates with 20-30 nm Cu underlayer can be used. The NiFe alloy can be plated under a constant current condition using a common DC power supply at room temperature.

This innovation is covered by U.S. Pat. No. 11,075,026. Potential Applications • Antennas • High-efficiency magnetic flux channel applications Benefits and Advantages • Cost-effective production • NiFe alloy demonstrates highly desirable magnetic properties: Magnetic conductivity of 6M to 9M ohms/m with peak magnetic permeability of 1500 to 2000. Faculty Profile of Professor Karl Sieradzki