Robert Acken
Graduate Student
Materials Science and Engineering, Virginia Tech

“Electroless-coating of Mo-Permalloy Flakes and Its Effect on Magnetic Properties of the Powder”

Abstract

New technologies being developed in the field of power electronic systems are all driven by the constant need of an increase in power density of power devices, which allows for the miniaturization of electronic devices. As frequency ranges are increased, the selection of magnetic materials that can perform efficiently becomes limited. At higher frequencies, magnetic metal materials experience increased loss due to their conductivity, in the form of eddy currents. Current industry practices to reduce eddy current losses involve applying a non-magnetic thin oxide film to magnetic materials, providing an insulating surface layer, ultimately increasing the operating frequency ranges of the material.

The present study investigates how a magnetic and insulating coating on Mo-Permalloy flakes affects magnetic properties and losses of the composite. A documented electroless plating method to deposit NiZn ferrite was followed to apply the coating. X-ray Diffraction was used to identify (311) and (220) peaks seen on a NiZn ferrite spectrum. After the coating was applied to a non-magnetic Mylar substrate, weak magnetization values of $6 \times 10^{-4}$ emu were recorded at 500 Oe before saturating using Vibrating Sample Magnetometry. A coating-time dependence study was done to measure the effects the coating had on permeability and loss by using an impedance analyzer. An increase in loss and decrease in bandwidth was observed with increased exposure to deposition settings. Four-point-probe measurements showed a decrease in resistivity with increased deposition time.

Biosketch

Robert Acken is a graduate student at Virginia Tech and a M.S. candidate in the Materials Science & Engineering department. Robert’s research interests include soft magnetic materials, power electronics, and thin film coatings. Robert received a B.S. in MSE at Virginia Tech in 2010, where he afterward worked in Pharmaceuticals and construction management before returning to further his education.