Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Yttrium Iron Garnet Thick Films Formed by the Aerosol Deposition Method for Microwave Inductors[1] SCOOTER JOHNSON, HARVEY NEWMAN, E.R. GLASER, SHU-FAN CHENG, MARKO TADJER, FRITZ KUB, CHARLES EDDY, JR., Naval Research Lab — We have employed the aerosol deposition method (ADM) to direct-write 40 μm-thick polycrystalline films of yttrium iron garnet (YIG, $Y_3Fe_5O_{12}$) at room temperature onto patterned gold inductors on sapphire substrates at a deposition rate of 1–3 μm/min as a first step toward integration into microwave magnetic circuits. A challenge to integrating magnetic films into current semiconductor technology is the high-temperature regime (900–1400°C) at which conventional ferrite preparation takes place. The ability of the ADM to form dense, thick films at room temperature makes this a promising approach for integrated magnetics where low-temperature deposition and thick films are required. The ADM YIG film has an rms roughness of 3–4 μm, is comprised of nano-crystalline grains with a density 50% of the theoretical value. XRD patterns of the as-deposited film and starting powder indicate a polycrystalline single-phase film. In-plane VSM and FMR measurements reveal a saturation of 22 emu/g, coercivity of 27 Oe, and linewidth of 360 Oe. Early measurements of air-filled and YIG-filled gold inductors between 0.01–10 GHz indicate an improved inductance of nearly a factor of 2 at low frequency. At higher frequency, resonance effects diminish this improvement.

[1]This work is sponsored by the Office of Naval Research under program number N0001413WX20845 (Dr. Daniel Green, Program Manager).

Scooter Johnson
Naval Research Lab

Date submitted: 14 Nov 2013 Electronic form version 1.4