EC03

Ni/Zn Ferrite Screen Printed Power Inductors for Compact DC-DC Converter Applications

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Recently, electrionic and communication systems become smaller and lighter, high frequency switched power DC/DC converters are being demanded with smll size, low profile, and low cost. In addition, for the decrement of ripple voltage, the operating frequency of control IC is increasing continuously [1]. To adress these issues, low profiled power inductors are developed by using screen-printing technology and Ni/Zn soft ferrite composites. These power inductors are fabricated on conventional PCB substrate in order to develop SiP (System in Package) based compact power converters.

These devices are based on screen printed polymer/ferrite composites and electroplated copper coils, and are deposited at low temperature, making them compatible with organic electronic packaging substrates [2]. In addition, the applied double stack spiral and circular geometry provide smaller size than single stack type one and higher quality factor than rectangular type one [3].

The screen-printed power inductor has a size of 5 mm × 4.5 mm × 0.45 mm. It exhibited an inductance of 380 nH and a quality factor of 11.42 at 6 MHz. These values are currently being improved by optimizing the coil geometry and improving the ferrite composite.

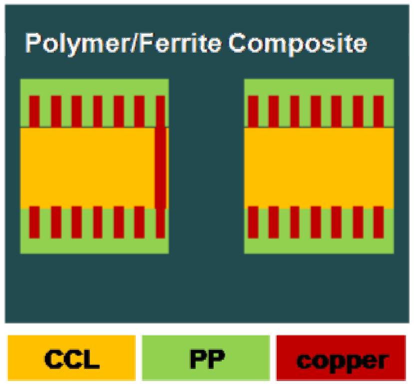

Fig. 1. Cross sectional view of proposed inductor.

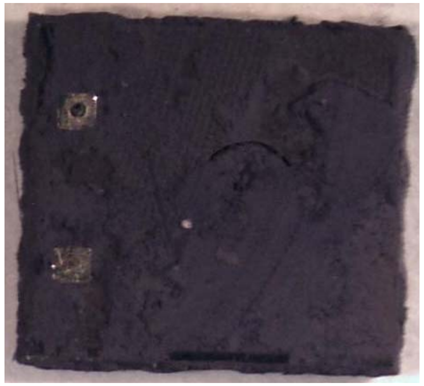

Fig. 2. Fabricated power inductor.

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EC04

Ferromagnetic Resonance Study of Annealed NiFe/FeMn/CoFe Trilayers

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Magnetic trilayers consisting of two ferromagnetic (F) layers separated by a nonmagnetic metal or insulating layer have been known to exhibit novel quantum phenomena such as an oscillatory interlayer exchange coupling and a spin-dependent tunneling during last decade [1]. Although several theories and experiments have been reported on a few systems so far, there has not been much attention about the magnetic trilayers intervened by an antiferromagnet (AF) [2]. Nowadays the NiFe/FeMn/ CoFe trilayer has become one of the pinned electrodes which have been widely utilized for the realization of magnetic tunnel junctions and a giant magnetoresistance spin valve. NiFe(bottom)/FeMn/CoFe(top) were grown on a silicon wafer with a native oxide using a magnetron sputtering in a ultrahigh vacuum of 2.0×10^{-9} Torr. 5-nmTa/5-nm Cu underlayer was inserted to induce a FeMn(111) texture and 5-nm Ta capping layer was deposited to prevent an oxidation. To induce the exchange anisotropy, a magnetic field of 300 Oe was applied along the film plane during a sample deposition. After being annealed at different temperatures up to 300^{o}C for 1 hour in a vacuum with a magnetic field of 150 Oe, the magnetic hysteresis (M-H) loop and the in-plane anisotropy distribution of the F/AF/F trilayers were measured with a vibrating sample magnetometer and a ferromagnetic resonance(FMR) spectrometer, respectively. Interestingly, the coercivity and exchange bias field of NiFe(CoFe) layers are 5(30) Oe and about 61(3) Oe in the as-deposited state and abruptly change into 12(32) Oe and 33(62) Oe after being annealed at 120^{o}C, respectively. After being annealed at 300^{o}C, a single F behavior is observed in the M-H loop. From in-plane angular dependence of the resonance field and the linewidth from FMR spectra, both uniaxial and unidirectional anisotropies in the CoFe layer and only a unidirectional anisotropy in the NiFe layer were observed. We suggest that the magnetic anisotropy of the NiFe layer is strongly influenced by a Ta/Cu underlayer, an applied field and exchange biasing by an AF layer deposition, while that of the CoFe layer is affected by the local polycrystalline AF grains, which might be oriented randomly between the AF grains in the film plane, and an applied field.

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