Fabrication of RF-Magnetic Inductor Using FeCrTaN films

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RF inductor is an important device for mobile communication electronics. When the commonly used air core inductor is implemented in Si-based ICs, serious parasitic capacitance as well as inductance loss occurs through Si substrate with high electrical conductivity. To solve this problem, back-side substrate etching techniques have been proposed using MEMS processes. However this approach involves complicated fabrication processes. Alternative method will be a use of inductor with soft magnetic films. Soft magnetic films encapsulating the inductor leads to the magnetic flux path localized inside the magnetic films, leading to absence of leakage flux through Si substrate.

Most important issue for realizing RF magnetic inductor is an availability of soft magnetic film, which can operate at GHz frequency range. It is known that high frequency degradation of thin magnetic films comes from ferromagnetic resonance. Thus, achievement soft magnetic film with high anisotropy field is important. Recently, S. Jin et.al.,have reported FeTaCrN films with high anisotropy field, and good high frequency characteristics up to 2 GHz.[1-2]. In this study, we further investigated the anisotropic properties of FeCrTaN films as a function of compositions, sputtering conditions, and field annealing. We also fabricated planar type spiral inductor using FeCrTaN.

FeCrTaN shows high value saturation magnetization up to 18 KG and good soft magnetism. The anisotropy field (Hk) is increased reaching 100 Oe by increasing Cr. This films shows good high frequency characteristics up to 2 GHz. The inductor using the FeCrTaN films also shows good operation performance up to 2 GHz.

References

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