INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Large linear sensitivity of CoFe based CIP-GMR magnetic sensor using metastable bcc Cu spacer and auxiliary biquadratic coupling through Rh spacer

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SHORT ABSTRACT

The development of magnetoresistance-based magnetic sensors has recently received enormous interest due to their tunable size, high sensitivity, and low power consumption, which makes them promising for applications in the air and space or automotive industry, non-destructive materials testing, biomedical sensors. One key issue is how to control the linearity of resistance change with the applied magnetic field. Therefore, this work focuses on the fabrication and characterization of Current In-Plane (CIP)-Giant Magnetoresistance (GMR) devices of CoFe(3 nm)/ Rh(x nm)/ CoFe(y nm)/ Cu(1.6 nm)/ CoFe(z nm)/ MgO(2 nm) with large linear sensitivity. The coupling between CoFe ferromagnetic layers is mainly controlled by metal stable body-centered cubic Cu spacer inducing antiferromagnetic coupling between CoFe layers and auxiliary biquadratic coupling through face-centered cubic Rh spacer layer to produce linear magnetoresistance response. The tuning of sensitivity parameters of the devices with Rh spacer layer thickness and thickness of CoFe layers was studied. The findings were supported from the numerical simulations to understand the nature of the coupling between different CoFe layers. A large linear sensitivity due to large MR ratio (21%) and linear response through a biquadratic coupling, high sensitivity of 47% /T, reduced nonlinearity of 0.98% full scale, along with more comprehensive operation field range of 220 mT could be successfully achieved, making it one of the simplest structure to achieve the largest sensitivity over a large field range using interlayer exchange coupling.