Spin Current and Magnetoresistance from the Orbital Hall Effect

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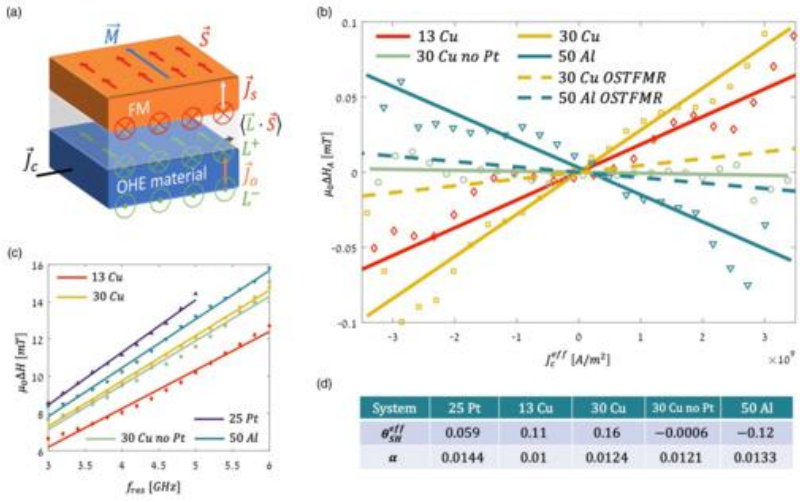
An innovative method to generate spin current and magnetoresistance by leveraging the Orbital Hall Effect (OHE). This approach utilizes ordinary metals like Aluminum and Copper, combined with a thin layer of heavy metal to convert orbital currents into spin currents. By minimizing the reliance on expensive heavy metals such as Platinum and Tungsten, the technology significantly reduces production costs while preserving performance, making it highly suitable for spintronic and magnetic devices.



System	25 Pt	13 Cu	30 Cu	30 Cu no Pt	50 Al
θ_{SH}^{eff}	0.059	0.11	0.16	−0.0006	−0.12
α	0.0144	0.01	0.0124	0.0121	0.0133

OHE measurement in Cu and Al: (a) Schematic of the trilayer system. (b) ΔHA vs. $Jeffc$ for Cu and Al systems; solid lines fit measurements, dashed lines show OSTFMR fits. (c) ΔH vs. $fres$, with traces shifted to cross origin for clarity. (d) Summary of θSH and α. 1

APPLICATIONS

- Magnetic field sensors
- Spintronic and spin-torque devices
- Memory devices and computational applications
- Data storage solutions
- Spin-based sensors for biomedical, environmental, and navigation uses

DEVELOPMENT STAGE

The technology has been demonstrated at the die level, generating spin currents via the orbital Hall effect in Copper and Aluminum, with a thin Platinum layer enabling measurable results consistent with theoretical predictions.

DIFFERENTIATION

Substantial reduction in heavy metal usage, lowering production costs

Compatibility with existing CMOS fabrication technologies

Independence from the Spin Hall Effect in Heavy Metals

Use of key semiconductor metals (e.g., Copper, Aluminum) for spin current generation