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MONOLITHIC SPINTRONIC OLED MAGNETOMETER

HARDWARE, CIRCUITS, & SENSORS

Thin-film semiconductor device allowing for ultrastrong magnetic resonant excitation electron spins. Allows magnetic field measurements as well as spin quantum bit manipulation.

TECHNOLOGY TYPE

Semiconductor
Magnetometry
Materials
Polymer

STAGE OF DEVELOPMENT

- Prototypes developed and integrated with existing magnetic resonance spectroscopy instruments.

- Ongoing research to optimize design.

IP PROTECTION

U.S. Utility Patent Pending
Spintronic Devices
U.S. Utility Patent Issued
Organic Magnetic Field Sensor
US9551772B2

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Reference Numbers:
U-6281, U-4862

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TECHNOLOGY SUMMARY

Magnetometers are used for a variety of sensor applications and various magnetometer concepts, each with different advantages and disadvantages. Currently available, low-cost room temperature magnetometers, however, must be calibrated for any environmental conditions under which they are operated. Most magnetometers are calibrated to account for a small range of normal operating conditions (e.g. a temperature range) only.

This monolithic organic thin-film semiconductor magnetometer eliminates the need for calibration. A dielectric thin-film provides electrical and thermal insulation between a thin-film wire, capable of inducing an AC magnetic field, and a layer stack in which spin-dependent electronic transition rates govern a measurable current. Magnetic resonance of the frequency of the AC field and the Larmor frequency of charge carriers in the thin-film device change the spin-dependent transition rates and thus, the electric current. Small electric current changes, indicative of magnetic resonance, reveal the magnetic field applied to the device.

FEATURES AND BENEFITS

- Eliminates the need for magnetometer calibration.
- Facilitates robust absolute magnetometry.
- Allows for monolithic integration of semiconductor thin-film devices with high-amplitude AC magnetic drive.
- Simplifies spectroscopy techniques including electron paramagnetic resonance spectroscopy.

RECENT PUBLICATIONS

Jamali, S., Joshi, G., Malissa, H., Lupton, J.M., Boehme, C. (2017). Monolithic OLED-microwave devices for ultrastrong magnetic resonant excitation. *Nano Letters.* 17(8): 4648-4653. doi: 10.1021/acs.nanolett.7b01135

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