Tohoku Univ. Technology

Magnetic field detection with a single planar element

Contributing to miniaturization of 3D magnetic field sensors for IoT applications

Overview

Magnetic field sensors are used in a variety of applications such as contactless current detection and electronic compasses, etc. Because an ordinary magnetic element detects only magnetic field components in a specific direction, detecting the direction of a magnetic field vector in 3D space requires a 3D combination of elements corresponding to each direction. This is an issue to device miniaturization and integration, which are rapidly increasing in demand in the IoT field.

This technology relates to the invention of a planar magnetic field sensor that does not require a 3D structure. The direction of the magnetic field vector in 3D space is determined from the voltage generated in each part of the ferromagnetic Fe-Sn thin films[1]. A 3D magnetic field sensor can be fabricated by patterning a single magneto-sensitive layer by a general-purpose device processing method. In addition to magnetic field sensors, this thin film can be expected to create new applications by combining functions[2-5].

Product Application

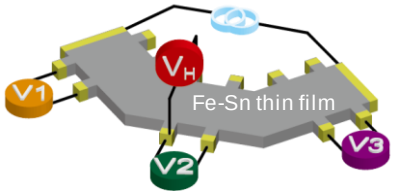
- Electronic compasses
- Security system sensor (Use Case : Doors open/close)
- Automotive angle sensor
- Angle sensor (Use Case : Foldable phones)

IP Data

IP No.	:	PCT/JP2022/006778
Inventor	:	TSUKAZAKI Atsushi, FUJIWARA Kohei, SHIOGAI Junichi
Admin No.	:	T21-257

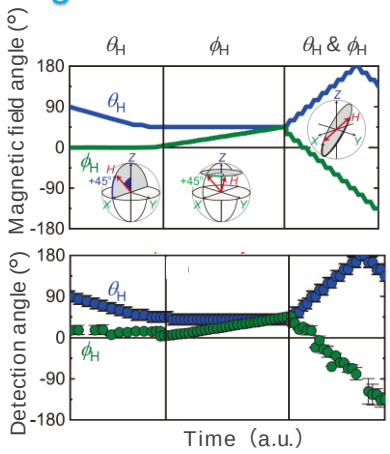
Features･Outstandings

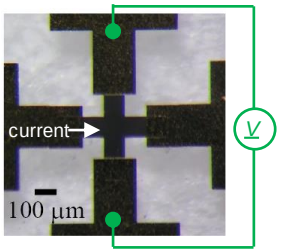
3D magnetic sensor by magnetoresistance



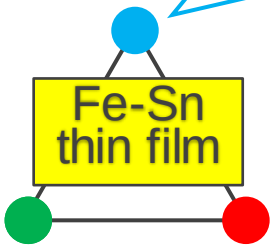
Left：Schematic diagram. It consists of a single thin film magneto-sensitive layer.

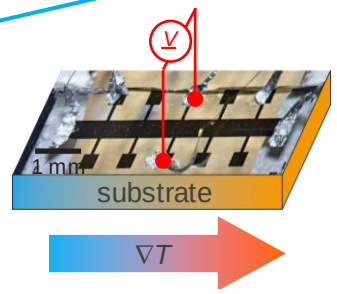
Right：Example of 3D magnetic measurement at 1 T（red arrow is magnetic field H）.





Hall sensor by anomalous Hall effect





Thermoelectric device using anomalous Nernst effect

Related Works

[1] Y. Satake *et al.*, *Sci. Rep.* **9**, 3282 (2019).
[2] Hall sensor, JP2018-157542.
[3] J. Shiogai *et al.*, *Commun. Mater.* **2**, 102 (2021).
[4] Magnetic sensor, JP2022-524242.
[5] K. Fujiwara *et al.*, OYO BUTURI **92**, p.20–23 (2023).

Contact

Tohoku Techno Arch Co., Ltd.
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