ADVANCED MATERIALS

Supporting Information

for *Adv. Mater.,* DOI: 10.1002/adma.201405027

Wearable Magnetic Field Sensors for Flexible Electronics

Michael Melzer, Jens Ingolf Mönch, Denys Makarov, Yevhen Zabila, Gilbert Santiago Cañón Bermúdez, Daniil Karnaushenko, Stefan Baunack, Falk Bahr, Chenglin Yan, Martin Kaltenbrunner, and Oliver G. Schmidt*

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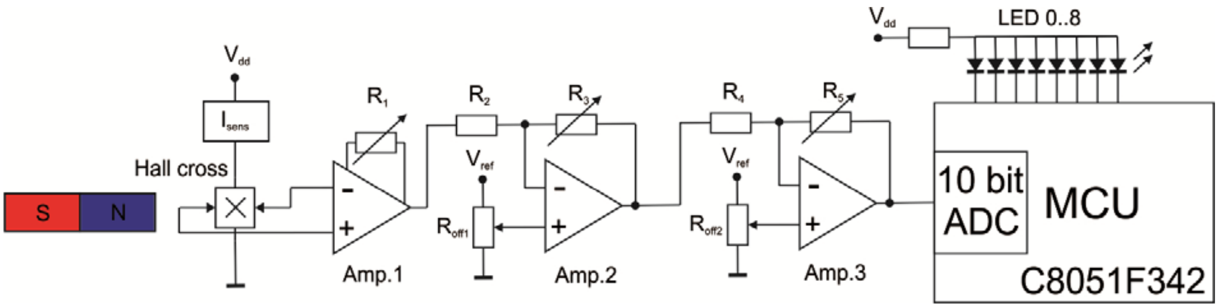
(1) Acquisition board for magnetic pointing device



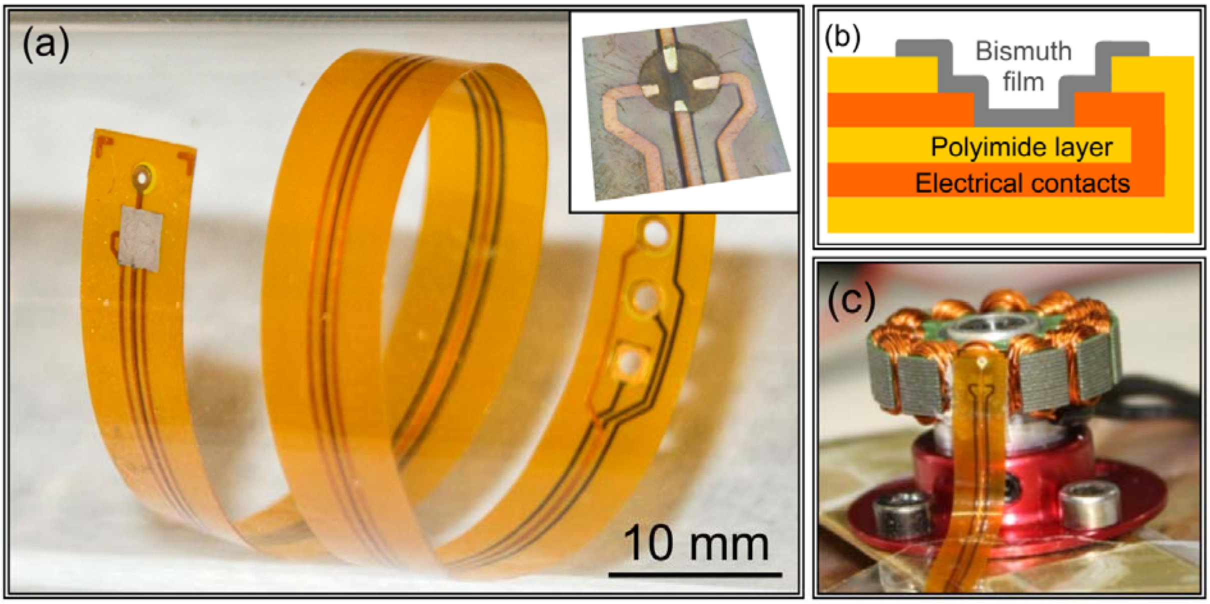
Supporting Figure S1. Diagram of the circuit which is used to condition the output signal of the flexible Hall sensors on the finger to enable their use for the pointing device.

(2) Electrical properties of the Bi films

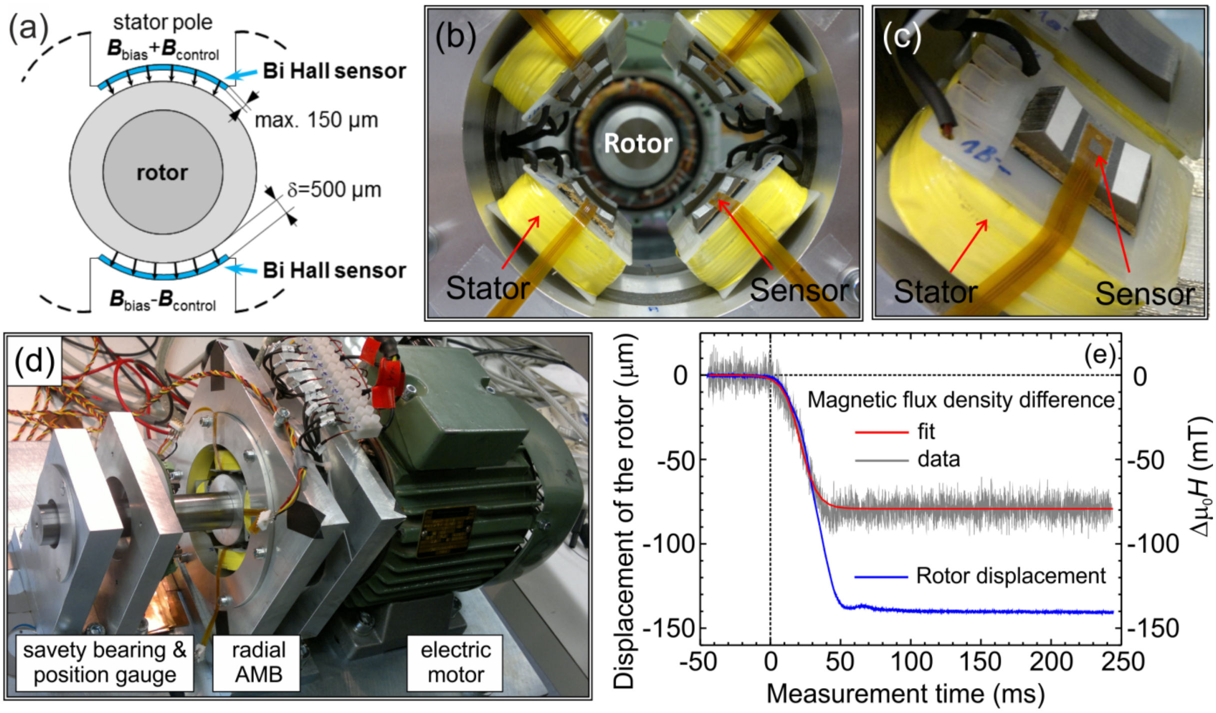
Supporting Table S1. Summary of electrical properties of the Bi films: 100-nm-thick Bi film prepared at different temperatures on flexible Polyimide and Polyetheretherketone (PEEK) foils. A comparison with the parameters of the films fabricated on a rigid Si wafer is given as well. The sample size is 10x10 mm^2. The electrical supply current used in these experiments is 1 mA and the electrical resistivity was measured in a standard 4-point configuration. The electrical resistivity of bulk Bi is 1.3 μΩ m.

Substrate	Deposition temperature (°C)	Hall sensitivity (mV/AT)	Electrical resistivity (μΩ m)
Polyimide	RT	-354	7.85
Polyetheretherketone		-214	7.69
Rigid Si wafer		-600	7.85
Polyimide	100	-384	7.21
Polyetheretherketone		-240	NA
Rigid Si wafer		-500	7.21
Polyimide	150	-1000	6.73
Polyetheretherketone		-410	6.57
Rigid Si wafer		sample not conductive	

(3) Application potential for electrical machines and drives



Supporting Figure S2. (a) Single flexible Bismuth Hall sensor prepared on a commercial FPC. A confocal 3-dimensional microscopy image of the FPC head prior to the Bi deposition is shown as inset. (b) Schematics of the Hall sensor cross-section taken along the geometrical center of the FPC. (c) Integration of the flexible Hall sensor on a stator pole of a brushless electrical motor.

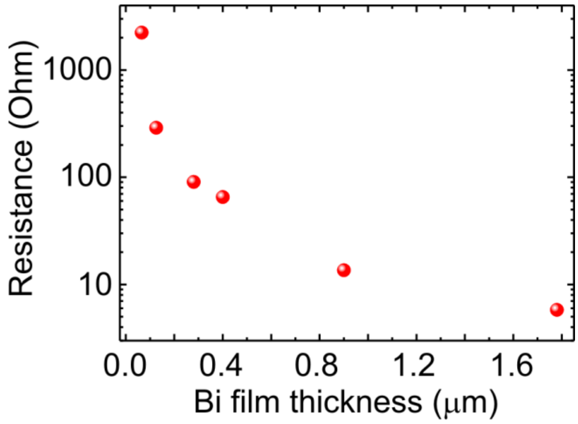


Supporting Figure S3. (a) Schematic of the sensor integration onto the curved stator pole of a permanent magnet biased AMB. (b,c) Integration of the sensors at the stator poles of the active magnetic bearing test setup shown in (d). (e) Monitoring the magnetic flux density change in one air gap of the AMB dependent on the rotor displacement.

Supporting Table S2. Parameters of the active magnetic bearing

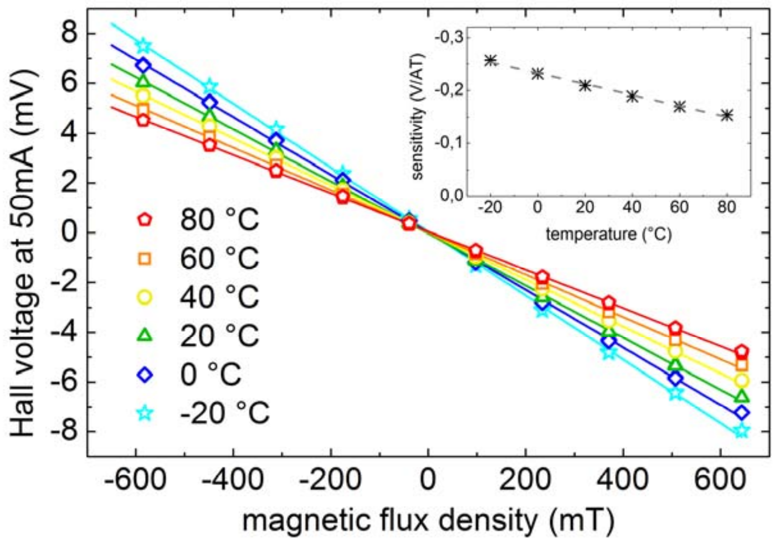
	Parameter	Value
$d_{s/r}$	Outer stator / rotor diameter	115 / 49 mm
δ	Magnetic air gap	500 µm
A_{pole}	Stator pole area	10x20 mm^2
B_{bias}	Permanent magnet bias	0.8 T
f_r	Rated force	460 N
k_x	Force-position factor	1.6 N/µm
k_i	Force-current factor	85 N/A

(4) Thickness dependence of the electrical resistance



Supporting Figure S4. Electrical resistance of the current-supplying contacts. The measurement is carried out on Bi films of different thicknesses deposited on PEEK foils at RT.

(5) Temperature dependence of Hall response



Supporting Figure S5. Performance of the Hall sensors upon temperature change. A 2-µm-thick Bi Hall sensor prepared on PEEK measured at different temperatures. The inset summarizes the sensitivity of the sensor with respect to the measurement temperature.