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Innovative Graphene Hall Effect Sensor for Extreme Temperatures

Łukasiewicz Research Network – Institute of Microelectronics and Photonics has developed the construction and technology of an innovative graphene-based magnetic field sensor.

The sensor is based on hydrogen-intercalated quasi-free-standing graphene epitaxially grown on semi-insulating silicon carbide using the Chemical Vapor Deposition method [1,2,3]. It is environmentally protected by atomic-layer-deposited aluminum oxide passivation.

Graphene's quality and the sensor's device technology is monitored by means of Raman spectroscopy, SIMS, spectroscopic ellipsometry, high-resolution XRR, SEM, AFM, high-resolution photo-induced transient spectroscopy and Hall effect measurements between the temperature of liquid nitrogen and 770 K.

The device comes in two variants. The one on semi-insulating vanadium-compensated on-axis 6H-SiC(0001) offers current-mode sensitivity of 140 V/AT within the temperature range between liquid nitrogen and 573 K [4], the other one on semi-insulating high-purity on-axis 4H-SiC(0001) offers 80 V/AT but up to 770 K [5].

The sensor holds promise for application in brushless electric motors, electric current sensors and magnetic field detectors operating under high temperatures and neutron irradiation [6]. Potential areas of competitive advantage include electric vehicles, charging stations, smart metering, high-temperature electronics and magnetic field confinement fusion reactors.

References

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Figures

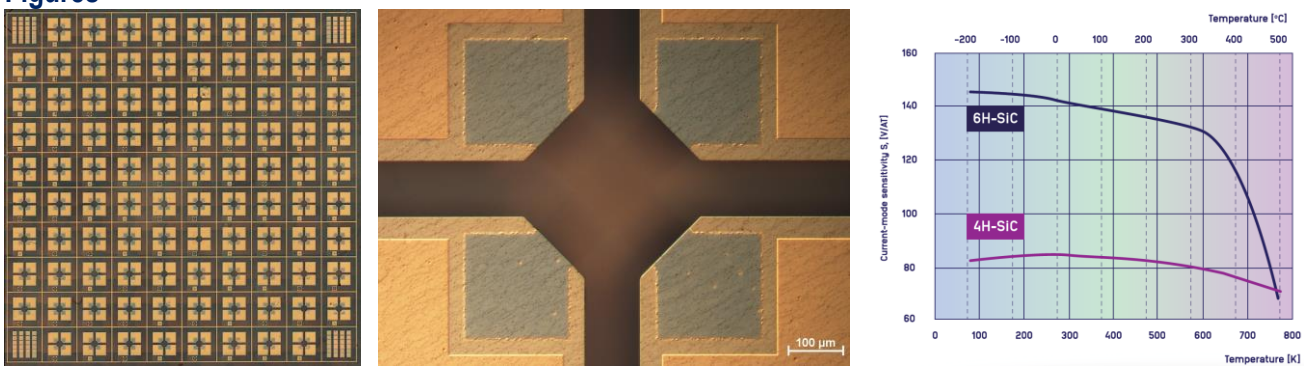

Figure 1: Optical image of the Hall effect sensor and a temperature profile of its current-mode sensitivity