

Room-temperature magnetoresistance of PVD deposited carbon films containing graphene nanocrystallites

Chao Wang

Jing Guo

Xingze Dai

Institute of nanosurface science and engineering, College of mechatronics and control engineering, Shenzhen University, 3688, Nanhai Avenue, Shenzhen, China

Cwang367@szu.edu.cn

Abstract

With the rise of artificial intellectual and nano technology, magnetic sensors are pervading widely and applied in modern industrial fields such as smart phone, wearable device and automatic machinery. In these products, the magnetic sensors are usually integrated on the main circuit board with other nano/micro sized devices. The core sensing unit is normally based on a film consisting of magnetic alloy or rare-earth semiconductor. Comparing to those materials, graphene is more economic and chemically stable, which can largely save the cost of materials, and extend the life of the sensors. However, the fabrication processes of graphene devices are much different from current circuit technology, which impede the development and application of graphene magnetic sensors. In this study, we produced carbon film with PVD deposition, which is compatible to current film sensor technology[1]. Nano-sized graphene crystallites are induced to form during deposition by electron irradiation in argon plasma, which provide abundant amount of graphene edges [2]. Since the magnetoresistance of graphene mainly origins from the spin-orbital related scattering of carriers at the edge sites [3-4], the carbon films showed obvious magnetoresistance behaviour in room temperature (see FIG 1). This research has provided a prospective pathway to fabricate carbon-based magnetic sensors in massive production, and shed light on applications of graphene devices in sensor technology.

References

- [1] C. Wang, D. Diao, Carbon, 112(2017) 162
- [2] C. Wang, X. Zhang, D. Diao, Nanoscale, 7(2015) 4475
- [3] A. Vianelli, A. Candini, E. Treossi, V. Palermo, M. Affronte, Carbon 89 (2015)188
- [4] J. Chen, J. Meng, Y. Zhou, H. Wu, Y. Bie, Z. Liao, D. Yu, Nat. Commun. 4 (2013)1921

Figures

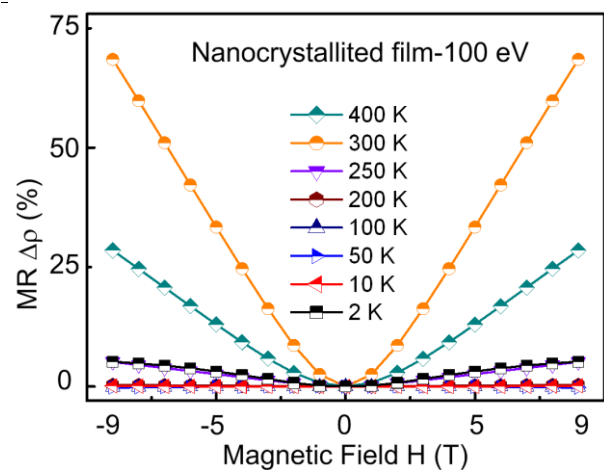


Figure 1: Magnetoresistance performances of carbon film in the temperature from 2-400 K.

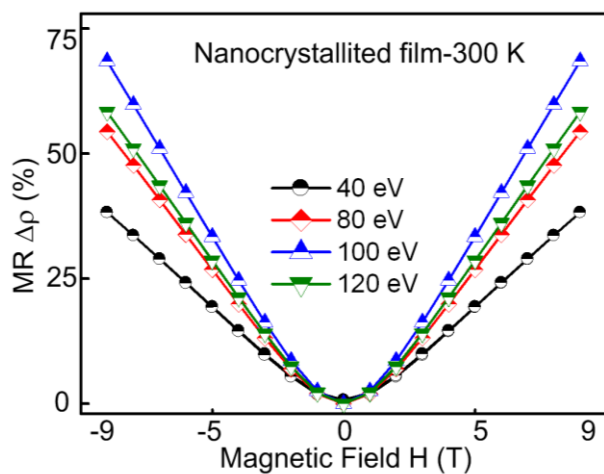


Figure 2: Room temperature (300 K) magnetoresistance of carbon films deposited with electron irradiation energy from 40-120 eV.