Polymer Covalently Modified Graphene for Nonvolatile Rewritable Memory

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Abstract: The data storage performance, stability and reliability of the graphene memories have advanced significantly towards practical information storage applications.[1,2] A number of essential strategies can be employed to control and optimize the switching characteristics of graphene memories for practical information storage applications. Covalent functionalization of graphene oxide(GO) or, reduced graphene oxide(RGO) with electroactive polymers is an effective and versatile approach to tuning the electronic properties of graphene. The facile engineering of GO/RGO energy bandgap through polymer functionalization also provides an alternative route to supplement the lithographical patterning of graphene sheets into low dimensional nanostructures and chemical modification of graphene nanoribbons. By using the "grafting to" or "grafting from" method, we have synthesized a new series of soluble polymer-covalently grafted GO/RGO functional materials. Bistable electrical switching effects and non-volatile rewritable memory effects were observed in the ITO/graphene-based polymer/Al sandwiched devices (Fig.1), with small switch-on voltage of about -1~-2 V and the ON/OFF current ratio of more than 10^3. The non-volatile nature of the ON state and the ability to write, read and erase the electrical states fulfilled the functionality of a rewritable memory. Both the ON and OFF states were stable under a constant voltage stress for more than 10^4 s and survived up to 10^8 read cycles at a read voltage of -1.0 V.

Reference

1. Y. Chen, B. Zhang,G. Liu et al.,*Chem. Soc. Rev.* 41(2012)4688–4707.
2. Y. Chen,G. Liu, C. Wang, W. Zhang, R.-W. Li, L. Wang, *Mater. Horiz.* 1(2014) 489-506.

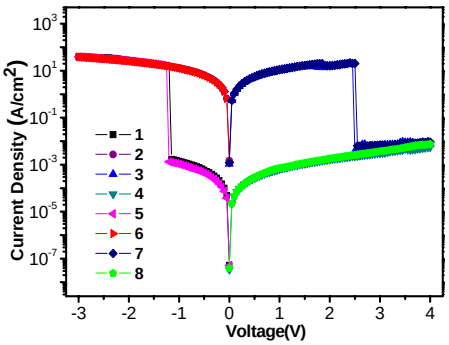

Figure 1. Typical current density-voltage characteristics of a 0.16 mm^2 Al/graphene-based polymer/ITO device.