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Flexible perovskite resistive random access memories employing graphene transparent conductive electrodes

Perovskite resistive random access memories (RRAMs) have received much attention due to their simple structure, high operation speed, low power consumption, and excellent scalability [1,2]. Perovskite materials are recognized as an attractive building block for RRAMs because perovskites exhibit novel dielectric, ferroelectric, semiconducting, and photosensitive functionalities. Recently, a device structure of Au/perovskites/ITO/ polyethylene terephthalate (PET) has been shown to be well working as flexible RRAMs [3], but ITO is not suitable for flexible devices. Here, we first report graphene transparent conductive electrode (TCE)-based flexible organic-inorganic perovskite RRAMs. Figure 1(a) shows a typical $MAPbI_3$ RRAM with graphene TCE on PET. The RRAM shows remarkable bipolar and bistable resistive switching behaviors with an on-off voltage < 1 V. In addition, the RRAM exhibits excellent bending stabilities, maintaining its initial resistive switching behaviors even after 1000 bending cycles at a bending curvature radius of 4 mm, as shown in Figure 1(b). These and other results are discussed based on possible physical mechanisms.

References

[1] Q. Liu, S. Long, H. Lv, W. Wang, J. Niu, Z. Huo, J. Chen, and M. Liu, ACS Nano, 10 (2010) 6162-6168.
[2] S. Gao, C. Song, C. Chen, F. Zeng, and F. Pan, J. Phys. Chem. C, 33 (2012) 17955-17959.
[3] C. Gu and J.-S. Lee, ACS Nano, 10 (2016) 5413-5418.

Figures

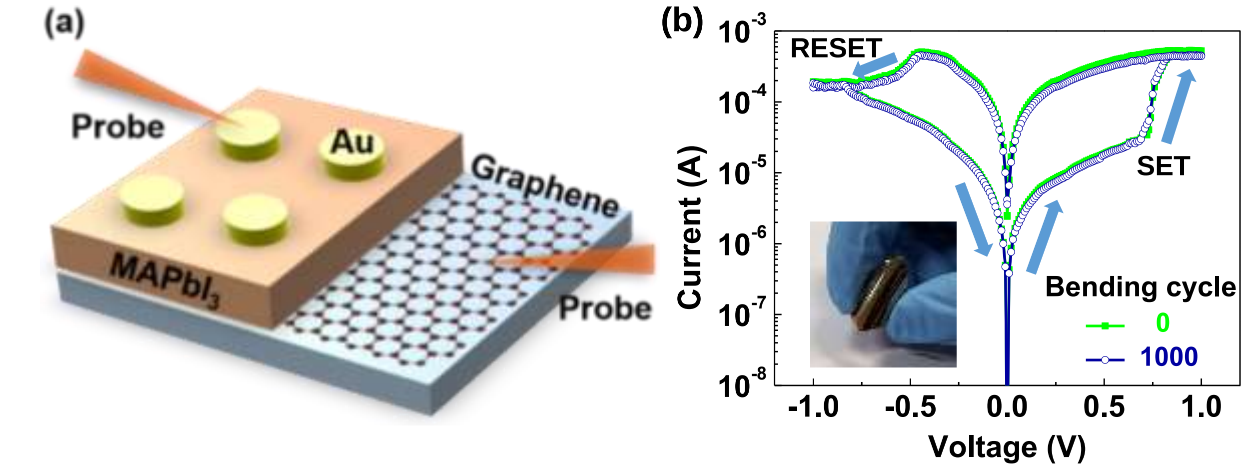

Figure 1: Flexible perovskite RRAM. (a) Schematic diagram of a typical perovskite RRAM with a structure of Au (top electrode)/$CH_3NH_3PbI_3$ perovskite layer/graphene (bottom electrode)/PET substrate. (b) Resistive switching properties of a typical perovskite RRAM after 1000 bending cycles at bending curvature radius of 4 mm. The inset shows a photograph of a flexible perovskite RRAM.