Organic Nonvolatile Resistive Switching Memory Based on a Controlled Diblock-Copolymer Nanostructure

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We demonstrated a facile method for a organic nonvolatile resistive switching memory via selective incorporation of fullerene derivatives, [6,6]-phenyl-C61 butyric acid methyl ester (PCBM), into nanostructure of self-assembled poly(styrene-b-methyl methacrylate) (PS-b-PMMA) diblock copolymer. PS-b-PMMA diblock copolymer provided a spatially ordered nanotemplate with a 10 nm PS nanosphere domain surrounded by PMMA matrix. It was found that spin casting of blend solution of PS-b-PMMA and PCBM spontaneously formed smooth films without PCBM aggregation in which PCBM molecules were incorporated within PS nanosphere domain of PS-b-PMMA nanostructure by preferential intermixing propensity of PCBM and PS. The ReRAM based on the well-defined PS-b-PMMA/PCBM nanostructure exhibited significantly improved bipolar-switching behavior with highly stable and reproducible properties at low operating voltages under the ambient condition compared to the devices based on homo-polymer composites (PS or PMMA : PCBM) Finally, the flexible memory devices were achieved and no degradation was observed before and after bending.