

Layer-by-Layer assembled Catalase Multilayer films for Nonvolatile Resistive Switching Memory Devices

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Research on Resistance random access Memory(ReRAM) has attracted attention as promising next generation nonvolatile memory. Various materials have been found to exhibit resistive switching property. We introduce redox enzyme as a new memory material. Although many studies in the field of bioelectronic are reported about Catalase which is a typical redox enzyme, most of them work in aqueous solution. In this study, we demonstrate electrical switching property of Layer-by-Layer(LbL) assemble catalase(CAT) multilayers that can be operate at dry state. The device shows bipolar resistive switching behavior including ON/OFF current ratio of $\sim 10^2$ under low operating voltage. This phenomenon is attributed to charge trap/release of heme $\text{Fe}^{\text{III}}/\text{Fe}^{\text{II}}$ groups in CAT. When the external bias is applied, the resistance state changes according to its redox reaction. Furthermore, we can enhance the memory performance by LbL assembly manipulation such as the insertion of insulating polyelectrolyte layers.