TT-P078

Resistive Switching Effect of the In_2O_3 Nanoparticles on Monolayered Graphene for Flexible Hybrid Memory Device

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The resistive random access memory (ReRAM) has several advantages to apply next generation non-volatile memory device, because of fast switching time, long retentions, and large memory windows. The high mobility of monolayered graphene showed several possibilities for scale down and electrical property enhancement of memory device. In this study, the monolayered graphene grown by chemical vapor deposition was transferred to SiO_2 (100 nm)/Si substrate and glass by using PMMA coating method. For formation of metal-oxide nanoparticles, we used a chemical reaction between metal films and polyamic acid layer. The 50-nm thick BPDA-PDA polyamic acid layer was coated on the graphene layer. Through soft baking at 125^{o}C or 30 min, solvent in polyimide layer was removed. Then, 5-nm-thick indium layer was deposited by using thermal evaporator at room temperature. And then, the second polyimide layer was coated on the indium thin film. After remove solvent and open bottom graphene layer, the samples were annealed at 400^{o}C or 1 hr by using furnace in N_2 ambient. The average diameter and density of nanoparticle were depending on annealing temperature and times. During annealing process, the metal and oxygen ions combined to create In_2O_3 nanoparticle in the polyimide layer. The electrical properties of In_2O_3 nanoparticle ReRAM such as current-voltage curve, operation speed and retention discussed for applictions of transparent and flexible hybrid ReRAM device.

Keywords: ReRAM, Graphene, Nanoparticles