Two-bit-per-cell resistive switching memory device with ITO/Zn_2TiO_4/Pt structure

Shi–Xiang Chen [1], Shoou–Jinn Chang [1], SHENG-PO CHANG [1], Cheng-Han Lin [1], and Kuan-Jen Chen [1]

[1]*National Cheng Kung University, Taiwan*

ZnO-TiO_2 alloy systems, such as $ZnTiO_3$,Zn_2TiO_4, and $Zn_2Ti_3O_8$, exhibited great potential as phosphors, catalysts, microwave devices, low-temperature co-fired ceramics (LTCCs), and dielectrics. Moreover, zinc titanate (Zn_2TiO_4),with an inverse spinel structure, has been used as a catalyst and dielectric in manufacturing. Its physical features, optical properties, and electrical characteristics have been studied for dielectric applications. Herein, a Zn_2TiO_4 RRAM device with an ITO/Zn_2TiO_4/Pt metal–insulator–metal(MIM) structure was fabricated and investigated. The RS behaviour of this RRAM device was systematically studied based on the forming and operation voltages, operation currents, high/low resistance ratio using methods such as RS cycle and retention time tests. The electrical properties and fabrication methods of the device were also discussed comprehensively. We discussed the fabrication procedure and device characteristics of ITO/Zn_2TiO_4/Pt resistive random-access memory (RRAM) at room temperature. Four different resistive states were obtained by applying different current compliances, all of which showed good retention characteristics with no obvious degradation and were individually distinguished after 10000 s at a read voltage of 100 mV. The set and reset voltages of the ITO/Zn_2TiO_4/Pt RRAM device were maintained within ±1 V.The device performed well at low operation voltages. The mechanisms of multilevel resistive switching characteristics were investigated to illustrate the multilevel carrier conduction phenomenon associated with Zn_2TiO_4 -based RRAM devices. In this study, our group illustrated the application of zinc titanate (Zn_2TiO_4) in non-volatile memories for the first time.

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