ReRAM characteristics utilizing pentacene/LaB_xN_y insulator stacked structure

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1. Introduction

Resistive RAM (ReRAM) is one of the emerging nonvolatile memory technologies because it has the advantages of high-density integration, high switching speed, and low power consumption [1].

We have reported OFET characteristics utilizing Pentacene and LaB_xN_y insulator [2]. In this study, ReRAM characteristics utilizing pentacene/LaB_xN_y insulator stacked structure was investigated.

2. Experimental procedure

First, the heavily doped p-Si (100) substrate was cleaned by SPM and DHF solutions. Then, a 10 nm thick LaB_xN_y insulator layer was deposited by RF sputtering utilizing N-doped LaB_6 target (N:0.4%). The Ar/N_2 gas flow rate was 10/7 sccm with sputtering gas pressure of 0.49 Pa. Then, a 15 nm pentacene was formed at RT by thermal evaporation under a vacuum pressure of 5×10^{-6} Torr. The deposition rate was 0.3 nm/min. Next, a 3 nm amorphous (α)-rubrene passivation layer was in-situ formed at RT on pentacene. Finally, the Au top electrode and Al back gate electrode were deposited by thermal evaporation. The device structure is shown in Fig. 1.

3. Results and Discussion

The ReRAM characteristics of pentacene/LaB_xN_y stacked structure was shown in Fig. 2. After the forming process, positive bias sweep from 0 to 3 V was applied. The resistance of the device was found to be switched from a high resistance state (HRS) to low resistance state (LRS) when the voltage reached to 2 V. After the second sweep from 3 V to 0 V, the device maintained its LRS. After the third sweep from 0 to –2 V, the device switched its resistance from LRS to HRS. Following the final bias sweep from –2 to 0 V, the device maintained its HRS.

4. Conclusions

We investigated the ReRAM characteristics utilizing pentacene/LaB_xN_y insulator stacked layer. The set and reset voltage of 2 and -1.5 V were obtained with the room temperature fabrication. It would be promising for flexible organic resistive random access memory applications with low operation voltage.

Acknowledgement

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References

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[2] E. K. Hong *etl al*, SSDM, p. 275 (2022).

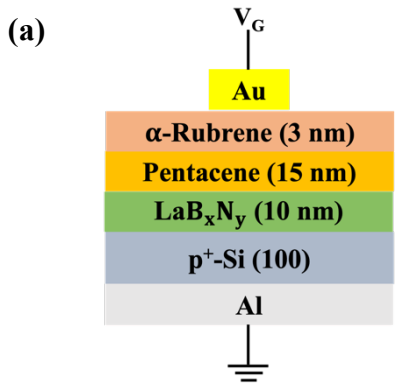

Figure 1. Structure of the device.

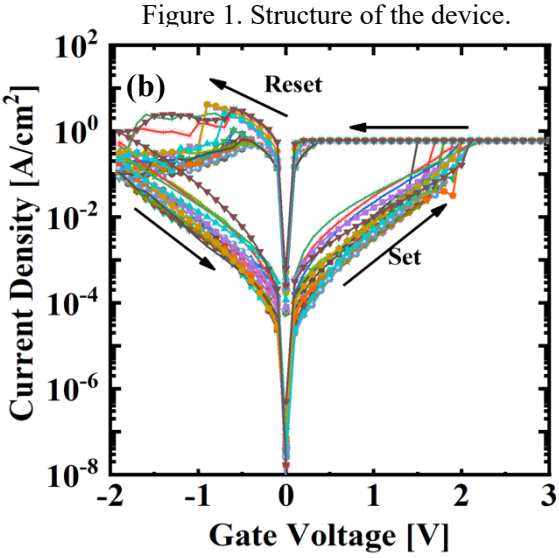

Figure 2. RRAM characteristics of pentacene/LaB_xN_y stacked structure.