Fully inkjet printed h-BN memristors

Kaichen Zhu,[1,2]
Giovanni Vescio,[2] Sergio González-Torres,[2] Julià López-Vidrier,[2] Juan Luis Frieiro,[2] Xu Jing,[1] Mario Lanza,[1*] Albert Cirera,[2] Blas Garrido[2*]

K. Zhu, X. Jing, Prof. Mario Lanza
Institute of Functional Nano & Soft Materials, Collaborative Innovation Center of Suzhou Nano Science & Technology, Soochow University, 199 Ren-Ai Road, Suzhou 215123, China
K. Zhu, Dr. G. Vescio, S. González-Torres, Dr. J. López-Vidrier, J. L. Frieiro, Prof. A. Cirera, Prof. B. Garrido
MIND, Department of Electronic and Biomedical Engineering, Universitat de Barcelona, Martí i Franquès 1, E-08028 Barcelona, Spain
Email: kczhu1995@126.com

Abstract
Layered hexagonal boron nitride (h-BN) has been proved to show switching behaviour for both information storage and neuromorphic computing [1-3]. However, synthesis methods like mechanical exfoliation and transfer after chemical vapor deposition (CVD) growth limit its industrial applications [4,5]. In this work, we introduce inkjet printing technology [6] to fabricate h-BN based memristors to achieve low cost and scalable mask-free fabrication. We have first synthesized inks containing h-BN nanoflakes, and then produced (at a low fabrication temperature <100 $^\circ$C) fully inkjet printed Ag/h-BN/Pt and Ag/h-BN/Ag devices. The devices show stable bipolar resistive switching behavior with high on-off ratio of 10^7, retention time $>10^5$ s at 85 $^\circ$C, and operation voltages less than ±1 V. The devices also show potential for multilevel data storage controlled by current limitation. This study indicates that inkjet printing is one promising fabrication method for large-scale memristor fabrication, especially for flexible electronics.

REFERENCES

[1] S. Chen et al, Nat. Electron. 3 (2020) 638.
[2] Y. Shi et al, Nat. Electron. 1 (2018) 458.
[3] C. Pan et al, Adv. Funct. Mater. 27 (2017) 1604811.
[4] L. Sun et al, Nat. Commun. 10 (2019) 3161.
[5] K. Zhu et al, ACS Appl. Mater. Interfaces 11 (2019) 37999.
[6] G. Vescio et al, ACS Appl. Mater. Interfaces 11 (2019) 23659.