Fully Printed 2D Material-based Heterostructures: from Memristic to Hysteresis Effects

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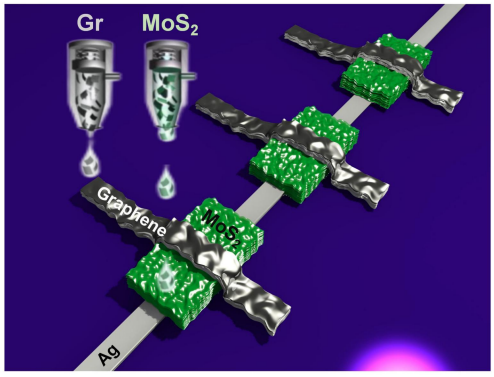
Realization of high density and reliable memristors is very important for the next generation information storage devices[1]. Solution processed 2-Dimensional Materials (2DMs) are very attractive for use in resistive-switching memories as they are compatible with low cost device fabrication processes and easily enable their integration into recyclable and flexible substrates such as paper.
In this work we investigated hysteresis and memristic effects of a fully inkjet printed 3-layers heterostructures made of water-based 2DM inks[2] and silver (used as bottom electrode only). Clear and reproducible resistive-switching effects were observed in the Ag/MoS_2/Gr heterostructure, providing low SET/RESET voltage, short switching times (within 0.1 s) and high resistance switching ratios (10^3-10^5).[3] By measuring the electrical output at different temperatures and by including CVD graphene as interface layer in the heterostructure, we found that the memristor resistance switching is attributed to the migration of Ag ions leading to conductive filaments as well as defects at the interface. Indeed, the use of CVD graphene not only enables to quench any memristic effect, but also eliminates any hysteresis, strongly improving device reproducibility.[3]

References

[1] M. A. Zidan, J. P. Strachan, W. D. Lu, Nature electronics, 1 (2018) 22-29.
[2] D. McManus, et al, Nature Nanotechnology, 12 (2017) 343-350.
[3] Peng et al, Adv. Fun. Mat, submitted

Figures



Schematic of fully printed Ag/MoS_2/Gr memristors.