Fully Printed Memristors made of Water-based 2D Material Inks

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Realization of high density and reliable memristors is very important for the next generation information storage devices.[1] 2D Materials (2DMs) based inks are very attractive for use in memristors as they enable use of simple and low cost fabrication processes, such as inkjet printing, and they can be easily integrated onto recyclable and flexible substrates, such as paper. However, only few works have reported fully printed memristors made of 2DMs. [2-4]

In this work we demonstrate a fully inkjet printed MoS_2-based resistive switching memory using water-based 2DM inks.[5] Silver is used as bottom electrode to enable the formation of conductive filaments providing resistance switching. The device shows low switching voltage, short switching times and resistance switching ratios of 10^3 –10^5 on rigid substrates, and 10^2 –10^3 on flexible substrates, where the signal remains stable for at least up to 2% of strain. Overall, our printed memristor shows comparable or superior performance as compared to devices with both printed silver electrodes.[6] We also performed variable temperature measurements to get insights on the fundamentals of the switching mechanism, and demonstrated that the migration of Ag ions can be suppressed by integrating CVD graphene onto the silver electrode.[6] Finally, we show successful coupling of the printed memristors with screen-printed graphene antennas and metasurface that enable low-cost and high energy efficiency wireless communications and sensing systems.[7]

References

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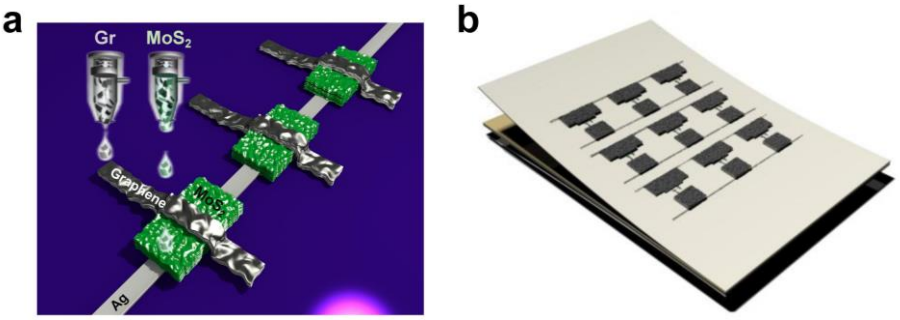
Figures



Schematic of (a) fully printed Ag/MoS_2/Gr memristors, (b) fully printed MoS_2 memristor coded reconfigurable graphene metasurface.