The study of 2D $CrPS_4$ based synaptic device

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To emulate the learning of biological synapses and overcome the energy and throughput limitations of neuromorphic computing systems, we need to high sensitivity and reproducibility are crucial for transmitting information quickly and accurately. But, they usually present limited high power consumption. Therefore, electronic devices that can have want characteristics with minimal performance variations remain limited.[1,2] Here, we demonstrate that two-dimensional layered single-crystal chromium thiophosphate ($CrPS_4$) can be used as a non-volatile binary resistive switching memory, which shows good switching uniformity, retention and endurance as well as ultralow operation voltages and high on/off ratio. The memory device can be also used for artificial ultrasensitive synapses with analog resistive switching and good reproducibility. In addition, with the help of ex-situ transmission electron microscopy and density functional theory (DFT) calculations, we observed that the behavior resulted from a resistive switching mechanism based on the migration of Ag ions from the active electrode to the $CrPS_4$ layer with sulfur vacancies.

References

[1] Yuanyuan Shi et al. *Nature electronics.* 1 (2018) 458
[2] Duygu Kuzum et al. Nanotechnology 24 (2013) 382001

Figures

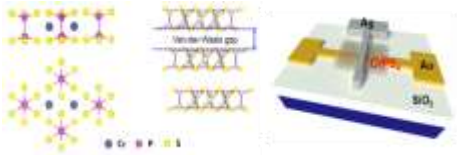

Figure 1: : Schematic image of 2D layered structure $CrPS_4$ and Ag/$CrPS_4$/Au synaptic device.