

Mi Jung Lee<sup>1</sup>, Sangik Lee<sup>1</sup>, Chansoo Yoon<sup>1</sup>, Sungmin Lee<sup>2</sup>, Jun Tae Jang<sup>3</sup>, Dae Hwan Kim<sup>3</sup>, Je-Geun Park<sup>2</sup> and Bae Ho Park<sup>1</sup>

<sup>1</sup>Division of Quantum Phases and Devices Department of Physics, Konkuk University, Seoul 05029, South Korea

<sup>2</sup>Department of Physics and Astronomy, Seoul National University, Seoul 08826, South Korea

<sup>3</sup>School of electrical engineering, Kookmin university, Seoul 136-702, South Korea

mj.lee0614@gmail.com

## The study of Two-dimensional van der Waals material memristor device.

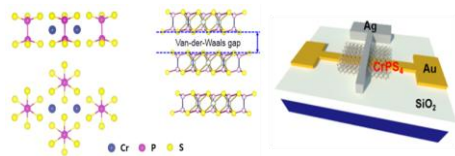
The development of reliable memristor devices capable of storing multiple states of information has opened up new applications as neuromorphic computing[1,2]. Recently, Reported ion migration based synaptic memristor devices using two-dimensional (2D) layered transition metal dichalcogenides (TMDs) materials such as MoS<sub>2</sub> and WS<sub>2</sub>. Native oxidized layer of sub nanometer thickness exhibits excellent synaptic plasticity and learning capacity close to the ~100mV level of neuron spike by electrically induced oxygen vacancy conductive bridge.[3] However, these devices has dimension limit as reducibility total thickness due to Native oxidized MoOx/MoS<sub>2</sub> and WOx/WS<sub>2</sub> heterostructure.

In this work, we fabricated memristor devices of M/I/M capacitor structures using 2D layered CrPS<sub>4</sub> single crystal electrolyte. It is used insulator part as electrolyte with controlled difference thickness by mechanical exfoliation method. We observed current-voltage (*I-V*) curves of bipolar resistive switching (RS) behaviors which occurred at low switching voltage with high on/off ratio. Furthermore, we demonstrated in our device including cation movements with multiple resistance states are controlled through repeated stimulation.

### References

- [1] Yang, J. J., Strukov, D. B. & Stewart, D. R. *Nat. Nanotech.* 8(2013), 13–24.
- [2] Borghetti, J. *et al. Nature* 464(2010), 873–876 .
- [3] Bessonov, A. *et al. Nat. Mater.* 14(2015) ,199–204 .

### Figures



**Figure 1:** Schematic image of memristor device and 2d layered structure of CrPS<sub>4</sub>.