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New varieties of Metal Sulphides / Phosphides for Electronics and Clean Energy applications

Abstract
Transition metal dichalcogenides (TMD) materials have attracted much attention due to their unique properties, ranging from low dimensional effects, good structural integrity, high electrical and thermal conductivity, and chemical stability. Increasingly, much of the applications have gradually progressed into different specific areas ranging from electronics to conductive coatings to biomedical technology.

In this talk, I will focus on new varieties of transition metal sulphides and phosphides, which are specifically designed and engineered. Two examples will be shown, the first is CuS, which is well known as a photosensitive material which possesses catalytical behavior. We will show there exist unique non-volatile memory behavior not previously known with low voltage switching of -3V and a switching speed of <20ms. Likewise, we will also show other forms of CoS where it has good water splitting capability. Likewise, we will demonstrate the more stable forms of metal phosphides, such as CoP and NiP where it has superior properties as compared to the more well studied sulphides in water splitting. We will also show some results where hybrid metal sulphides and phosphides can enhance catalytical reactions.

References

[1] Yu S.H. and D.H.C Chua, ACS Applied Materials & Interface, DOI: 10.1021/acsami.8b02755
[2] Ng Z.Q.C, R.K.K.Tan, A.Rath, A.T.S. Wee and D.H.C. Chua, Applied Physics Letters, doi: 10.1063/1.5027129

Figures

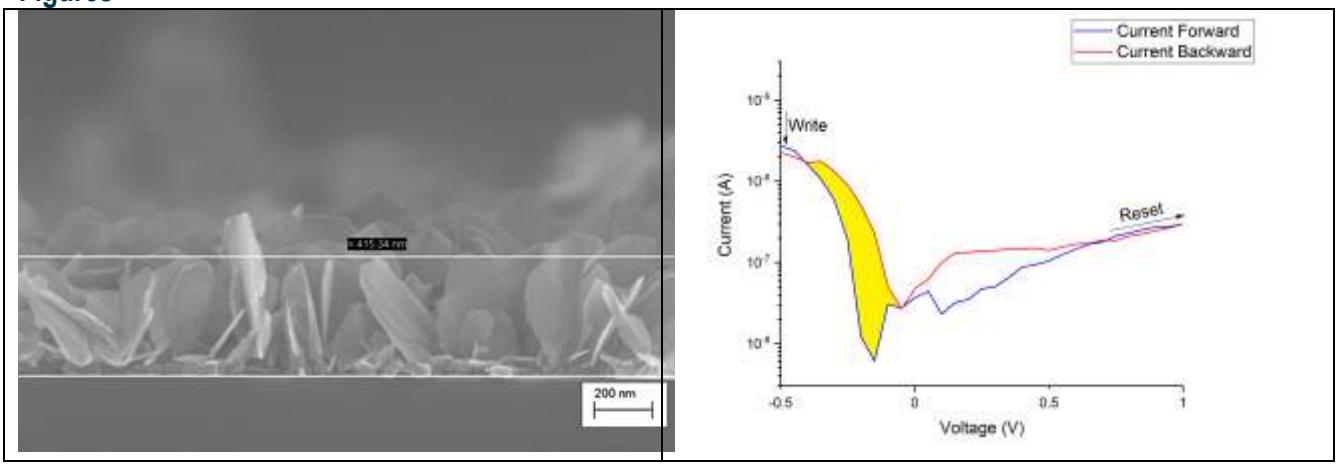

Figure 1: 2 dimensional flat plates of CuS with resistive random access memory behavior.