Transition Metal Dichalcogenides

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Two-dimensional materials are materials with a thickness of a few angstrom that have gained significant scientific attention the last two decades due to their amazing and exotic properties. Graphene was the first 2D material that was isolated back in 2004 by Geim and Novoselof, leading to the Nobel Prize in physics 6 years later. Despite its unique properties, the absence of a band gap has made graphene unsuitable for several applications, therefore, the need for new 2D materials emerged. To overcome this problem, research on new types of 2D materials was initiated, leading to the isolation of MoS_2 in 2010, the first Transition Metal Dichalcogenide (TMDs).

Transition Metal Dichalcogenides are two-dimensional semiconductors with a direct band gap in optical regimes that make them very interesting for photonics and optoelectronics applications. In this presentation, we will examine the methods used to synthesize TMDs and discuss their properties and their applications [1].

A new field of studies has emerged and more scientific research is required in order to better study and understand these new 2D materials. It is widely known that 21st century electronics are based on silicon, are TMDs capable of replacing silicon in the near future?

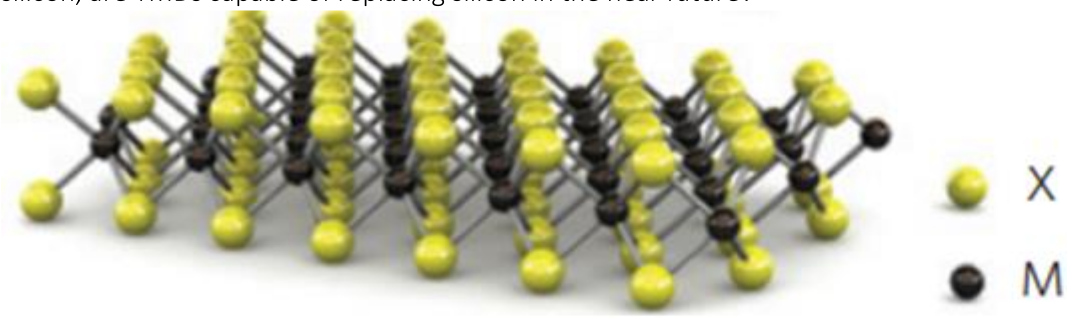

Figure 1. Schematic representation of a transition metal dichalcogenides (with the chalcogen atoms (X) in yellow and the metal atoms (M) in grey).[2]

References

[1] Manzeli, S., Ovchinnikov, D., Pasquier, D. et al. (2017). 2D transition metal dichalcogenides. Nature Reviews Materials 2, 17033. https://doi.org/10.1038/n

[2] Wang, Q., Kalantar-Zadeh, K., Kis, A. et al. (2012). Electronics and optoelectronics of two-dimensional transition metal dichalcogenides. Nature Nanotech 7, 699–712. https://doi.org/10.1038/nnano.2012.193