

Phyllosilicates as functional dielectrics in two-dimensional materials-based electronics

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Since the last decade, the number of isolated two-dimensional (2D) materials keeps growing exponentially, focusing on high-performance semiconducting and spontaneously polarized materials. However, the number of vdW insulators is extremely disproportional to both semiconductors and metals. Almost exclusively the entire field relies on hexagonal boron nitride. Surely, this cannot be the only technologically relevant system.

Inspired by naturally occurring van der Waals (vdW) crystals – 2D minerals – from the phyllosilicate family, our team works on establishing 2D phyllosilicates as a multifunctional vdW dielectric platform. In this talk, we will focus first on intrinsic magnetism in phyllosilicates. We will look into the first direct observations of the magnetic domains, their layered antiferromagnetic ordering, and ion implementation as a potential pathway to engineer magnetic impurities. Afterwards, we will look into the potential application of non-magnetic phyllosilicates as hBN alternatives in 2D materials-based transistors, and opportunities for this material class to be used as charge-trap layers for computing in memory applications. Lastly, we will focus on their potential as a substrate for heteroepitaxy of 2D semiconductors.