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Novel two-dimensional materials for applications in chemistry, physics, and materials science

Van der Waals (vdW) 2D materials are found in various polytypes and can easily be exfoliated into monolayers. Stacking different single layers on top of each other creates heterostructures, which exhibit intriguing chemical and physical properties. These properties include the formation of moiré structures or interlayer excitons, among others. The characteristics of such vdW systems can further be fine-tuned through external factors, such as applied electric fields, tensile strain, or the twist angle between layers.
Within our research group, we focus on the exploration of 2D vdW materials, including transition-metal dichalcogenides, graphene, and 2D polymers, just to mention a few. We investigate their potential applications in fields, such as (opto)electronics, hydrogen isotope sieving and transport, and catalysis. These materials hold particular significance for these applications because they confine electrons to two dimensions. Additionally, their properties are distinct from those of their bulk parent systems and are uniquely manifested at such lower dimensions. I will present some of the most recent investigations carried out in the group, which are also part of two ongoing projects, Collaborative Research Center CRC1415 and Research Training Group RTG 2721.

References

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Primary author: KUC, Agnieszka Beata (CASUS/HZDR)

Presenter: KUC, Agnieszka Beata (CASUS/HZDR)

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