Carbon-based van der Waals heterostructures of 2D materials

Andrey Turchanin

Friedrich Schiller University Jena and Jena Center for Soft Matter (JCSM)
07743 Jena, Germany

By stacking various atomically thin sheets (e.g., graphene, MoS_2, or BN), novel van der Waals (vdW) heterostructures can be engineered even if these material combinations cannot be grown directly by physical vapor deposition techniques. In this way, vdW heterostructures with tailored electronic and optoelectronic properties can be generated by combining metallic, insulating and semiconducting nanosheets. Here, the fabrication and characterization of all-carbon vdW heterostructures consisting of graphene, carbon nanomembranes (CNMs) and organic semiconductor nanosheets will be presented.[1-6] It will be shown how other carbon-based low dimensional materials (e.g., fullerenes, dyes, or metalorganic catalysts) can be integrated into these layered structures enabling for new functionallity.[3-4] Moreover, implementation of the assembled hybrid all-carbon vdW heterostructures will be demonstrated in (i) high performance field-effect devices[2,6]; (ii) electrochemical nanosensors; (iii) photo-switchable transistors.

References

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