Hybrid Inorganic/Organic Systems for Opto-Electronics

Collaborative Research Centre 951

Colloquium Announcement

of the Collaborative Research Centre 951
"Hybrid Inorganic/Organic Systems for Opto-Electronics"

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Van der Waals semiconductors: synthesis to photonic devices

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Van der Waals semiconductors: synthesis to photonic devices

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Two-dimensional (2D) van der Waals semiconductors such as monolayer MoS_2 and WSe_2 are an attractive building block for novel photonic devices due to their strongly excitonic character. In this talk, I will first discuss the behaviors of excitons in these 2D materials in device structures, particularly focusing on various approaches to realizing electrical generation, manipulation, and detection of excitons and their complexes. MIS-type van der Waals heterostructures are an interesting platform that allows electrically tunable excitonic electroluminescence [1] and electro-optic upconversion in linear optics regime. We find evidence of unipolar tunneling across few-layer hexagonal boron nitride which leads to nearly perfect conversion of electrical current to excitons under certain conditions. The second part of the talk will focus our recent discovery of a novel 2D MoS_2 growth mechanism based on vapor-liquid-solid conversion [2]. We show that alkali metal plays a key role in reducing the melting point of the precursors and triggering the vapor-liquid-solid mode, yielding expitaxially grown monolayer nanoribbons.

[1] S. Wang *et al., Nano Lett.* 17, 5156 (2017).

[2] S. Li *et al., Nat. Mater.* 17, 535 (2018).