Engineering 2D materials: from photonics to magnetism

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Intriguing properties of 2D materials make them attractive for a wide range of novel applications from catalysis to quantum information technologies. In order to implement them into desired applications, however, ability to tailor their physical properties by materials engineering is crucial. In this talk, I will discuss our recent effort on the synthesis and understanding of chemically engineered 2D materials. The first part of the talk will focus on modified chemical vapor deposition of transition metal dichalcogenide monolayers where substitutional doping is achieved by solution-phase mixing of precursors. The dopants remain electrically inactive due to large activation energy but yields distinct impurity-induced localized emission at low doping concentrations. The second part of the talk will focus on tailoring of the magnetic properties of $Cr_2Ge_2Te_6$ (CGT), a van der Waals ferromagnetic semiconductor, by electrochemical and chemical means. We show that degenerately electron-doped CGT exhibits enhanced Curie temperature of up to 240 K, and rotation of its easy axis from out-of-plane to in-plane orientation.