Characterization of defects in 2D materials with tip enhanced Raman scattering

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Recently,2 dimensional(2D) nanomaterials such as graphene, boron nitride, and layeredtransition-metal dichalcogenide (TMdC) materials with the chemical structureMX2 (M = Mo, W, Ti, V, Ta, Hf, Pt and X = S, Se, Te) have attractedconsiderable interest in the fundamental sciences and applications. In thispresentation, analysis of 2D nanomaterials with Tip enhanced Raman scattering (TERS)will be provided. TERS is a unique tool for investigating Raman scatteringmapping with nanometer spatial resolution beyond optical diffraction limit. Usingrepresentative tips fabricated under the optimal etching condition, wedemonstrate the TERS experiment of tungsten disulfide (WS_2) monolayergrown by a chemical vapor deposition method with a spatial resolution of ~40nm. Monolayer WS_2 has been especially known for its highphotoluminescence(PL) quantum yield, which is greater than that of monolayerMoS_2. However, the conventional PL and Raman spectroscopy have alimit to analyze nanoscale structures such as local disorders, grainboundaries, dopants, and edges which affect to the optical properties of WS_2.Here, we conduct systematic studies to investigate monolayer WS_2 byusing TERS. As measuring monolayer WS_2 on a gold foil, PL backgroundcan be quenched by a charge transfer. We also measure the surface morphology ofWS_2 by a scanning tunneling microscope and scanning electron microscopeto compare with TERS images.