From nanoparticle to monolayer: wafer-scale growth of transition metal dichalcogenides (TMDs) and their alloy monolayers from nanoparticle precursors

김지훈, 박정원†
서울대학교
(jungwonpark@snu.ac.kr†)

Transition metal dichalcogenides (TMDs) monolayers have unique physical properties including exciton dynamics and direct bandgap, deviating from their bulk counterparts. For utilizing 2D TMD materials in applications, TMD monolayers with desired size and composition have to be produced in a controllable way. Thermal CVD is effective for TMD monolayer growth with large grain size in a short time. However, the size and composition of TMD monolayers are irregular on the entire substrate because of the difficulty in controlling multiple powder precursors in the process. Here, we develop a new type of CVD process for uniform growth of TMDs and their alloy monolayers enabled by using nanoparticle precursors on 2-inch wafer. Uniform deposition of nanoparticles facilitates reproducible and massive production of TMD monolayers. Furthermore, mixture of different nanoparticle precursors in a ratio promotes the growth of TMD alloy monolayers with controlled compositions on 2-inch substrate. Our method provides the massive production of 2D TMDs with tunable physical properties by changing size, morphology, and doping level for future applications.