Chemical vapor deposition growth of 2D heterostructure of MoSe2/WSe2

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Heterostructures composed of two-dimensional (2D) semiconductors exhibit exceptional electrical and optical characteristics stemming from quantum confinement, strong light-matter interaction, and artificially tunable band alignments. Especially, a type Ⅱ band alignment is desired as it promotes charge transfer for both carriers and high built-in potential. Furthermore, PN junctions with high built-in potential are desired to improve device performance. Here, we propose the CVD growth of 2D heterostructures comprising $MoSe_2$ and WSe_2. First, a liquid precursor, a mixture of MoO_3 and NaCl, was spin-coated on the c-sapphire substrate. Then, $MoSe_2$ domains were primarily grown via the CVD method, in which the optimization of growth parameters resulted in aligned growth. Subsequently, the as-grown $MoSe_2$ islands on the c-sapphire substrate were used as the template for the growth of WSe_2 using oxide precursors. Our approach combining liquid/solid precursors to fabricate heterostructures offers an insight into the development of ultrathin electronic/optoelectronic devices based on 2D semiconductors.