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Growth and Application of 2D Transition Metal Dichalcogenides

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The direct-gap property of the semiconducting transition metal dichalcogenide monolayers are attractive for optoelectronics and energy harvesting. Here I would like to discuss the synthetic approach to obtain sub-mm sized MoS₂ (WSe₂) monolayer directly on arbitrary substrates using vapor phase reaction between metal oxides and S or Se powders. The bandgap tunable monolayer alloy such as MoS_xSe_y or WS_xSe_y can be obtained by the replacement reaction between Se and S. These layer materials can be transferred to desired substrates, making them suitable building blocks for constructing multilayer stacking structures. Applications such as flexible electronics, ultrahigh gain photodetector and extremely sensitive DNA detection shall be discussed.