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Vapor phase growth of van der Waals epitaxial VSe_2/WSe_2 heterostructures

We report vertical heteroepitaxial growth of 1T-VSe_2/2H-WSe_2 monolayers (MLs) by a sequential chemical vapor deposition method. Therein, 1T-VSe_2 MLs are known as ferromagnetic metals at room temperatures, and 2H-WSe_2 MLs are a typical semiconductor with the band-gap of 1.68 eV, establishing a unique spintronics component in the atomic ML regimes. By transmission electron microscope (TEM) studies, it is verified that the two MLs were coherently stacked with van der Waals epitaxial relations without interlayer mixing. We also discuss on charge transport across 1T-VSe_2/2H-WSe_2 ML heterointerfaces by low-temperature electron transport.

References

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Figures

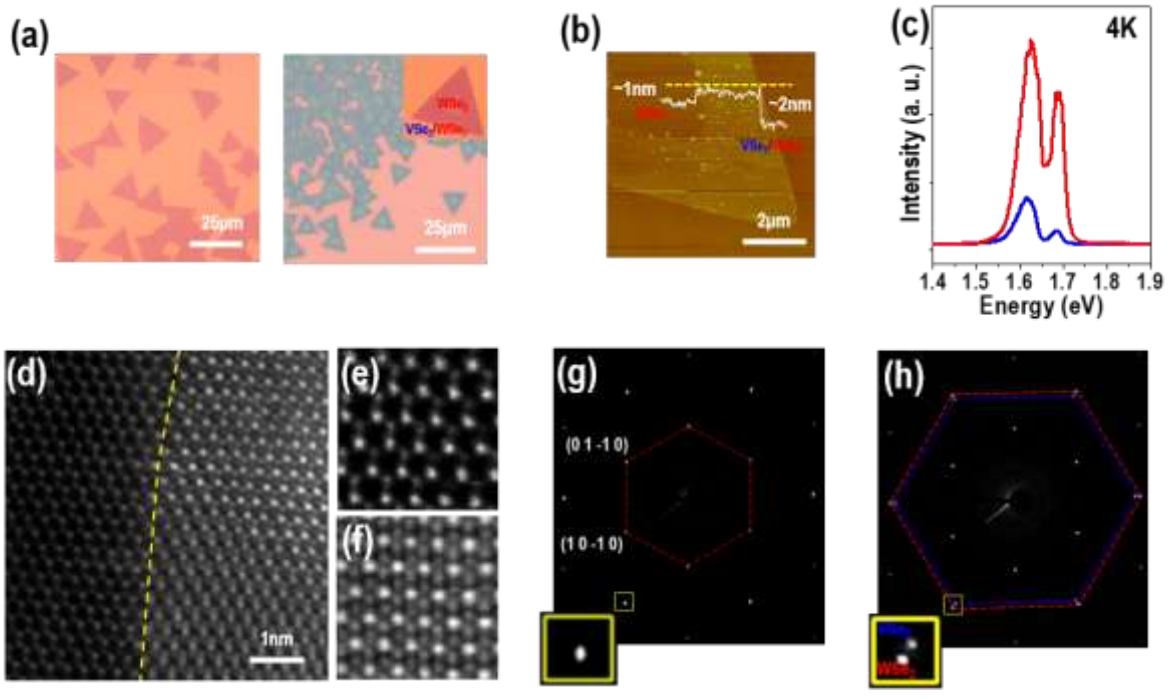

Figure 1. (a) Optical microscope (OM) images of MLs WSe_2 (left) and bilayer VSe_2/WSe_2 (right). Inset : OM images of heteroepitaxial stacked VSe_2/WSe_2 crystal. (b) Atomic force microscopy (AFM) morphology image and height profile. (c) Photoluminescence (PL) spectra measured from ML WSe_2 region (red) and stacked region (blue) at 4K. (d) High-magnification high-angle annular dark field scanning transmission electron microscope (HAADF-STEM) image at the step edge. (e) Atomic-resolution HAADF-STEM image from WSe_2 ML region. (f) Atomic-resolution HAADF-STEM image from VSe_2/WSe_2 stacked region. (g) Selected area electron diffraction (SAED) patterns from WSe_2 ML region. (h) SAED pattern from VSe_2/WSe_2 stacked region.