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Studies of the epitaxial monolayer $NbSe_2$ by ultra-low-temperature scanning tunnelling microscope SHUAI-HUA JI, State Key Laboratory of Low-Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China. — Monolayer $NbSe_2$ has been successfully synthesized by molecular beam epitaxy on the graphitized SiC(0001) surface. Wide substrate temperature window from 200°C to 650°C for the epitaxial growth has been observed. The polycrystalline nature of the epitaxial sheet, which is caused by the weak Van der Waals interaction with substrate, has been evidenced by reflection high-energy electron diffraction and locally by scanning tunnelling microscope. Under the high temperature growth condition, grain size could reach as large as hundreds of nanometers. The shape of grain boundary is strongly depended on the misaligned angle between adjacent grains. Mainly, three type grain boundaries have been identified at the atomic scale by the local scanning probe. The BCS-like superconducting gap and the spatial fluctuation of order parameter have been revealed by ultra-low temperature scanning tunnelling microscope in the sub-Kelvin range.

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