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Growth of Dielectric SrTiO₃(111) Film with Atomically Well Defined Surface¹ JIANDONG GUO, YAN LIANG, WENTAO LI, SHUYUAN ZHANG, Institute of Physics, Chinese Academy of Sciences — Oxide heterointerfaces exhibit novel properties that can be controlled by external fields. The (111) surfaces of perovskite oxides are particularly interesting since the six-fold symmetry is compatible with other quantum materials, e.g., topological insulators. We grow high quality SrTiO₃(111) film on Nb-doped substrate by oxide molecular beam epitaxy. By adjusting the flux rates of Sr and Ti, we keep the reconstruction of film surface unchanged as that on substrate all through the growth. Thus the cation stoichiometry is achieved since the surface reconstruction is determined by Sr-Ti concentration ratio and can be monitored in real-time. Moreover reconstruction allows the stable layer-by-layer growth of the polar film. The in situ scanning tunneling microscope shows the atomically well defined film surface with broadened terraces. And the C-V measurements indicate that the tunable range of the carrier density is 2E13 per cm² for a 50 nm film. This insulator/metal homoepitaxial system provides a template for the growth of novel low-dimensional structures with flexible tunability by gate voltage.

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