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Room temperature growth of Mg on the Si(111)-7×7 surface studied using STM and LEED

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The adsorption geometry and the electronic property of Mg grown at room temperature on the Si(111)-7×7 surface with various coverages have been studied by scanning tunneling microscopy (STM) and low energy electron diffraction (LEED). At low Mg coverage, the Mg atoms preferentially adsorb at the center adatom sites of the faulted half of the Si(111)-7×7 surface. The adsorbed Mg atom acts as nucleophile with respect to Si atoms thus forms a stable ionic bond with the substrate Si atoms. Above 1 ML, the 7×7 surface starts to be disrupted and an amorphous Mg overlayer is formed. The LEED shows either δ 7×7 or 1×1 pattern at this coverage. When more Mg atoms were exposed, a flat and broad $\frac{2}{3}\sqrt{3}\times\frac{2}{3}\sqrt{3}R30^{\circ}$ region evolves. A flat silicide is formed at first and multi-level Mg islands having hexagonal step edges develop with increasing coverage. The scanning tunneling spectroscopy (STS) confirms the electronic properties of these Mg films on the Si(111) 7×7 surface at various coverages.