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A kinetic scanning tunneling microscopy study of iron silicide growth on Si(113)

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Abstract

High-temperature kinetic scanning tunneling microscopy (STM) studies are used to investigate the surface morphology and growth mode of iron silicide on Si(113) formed by gas-source reactive iron deposition with $Fe(CO)_5$ as precursor. The first monolayer of silicide on Si(113) forms a $(4 \times n)$ reconstruction that covers the surface completely before growth proceeds via the formation of strongly anisotropic, three-dimensional silicide islands. After the first monolayer is closed, growth is slowed down by a blocked interdiffusion with the silicon substrate and a reduced sticking probability for the precursor. Lateral spreading of the islands is achieved by a stoichiometric codeposition of iron and silicon using $Fe(CO)_5$ and Si_2H_6. In this way, nearly closed layers of silicide can be grown.

Keywords: Low energy electron diffraction (LEED); Metal–semiconductor nonmagnetic thin film structures; Scanning tunneling microscopy; Silicides; Single crystal epitaxy