

Pervasive alloy anchoring silicene to silver.

David A Duncan,¹

1. Diamond Light Source, Harwell Campus, Didcot, OX11 0DE

Silicene is the two-dimensional (2D) allotrope of silicon, and is the silicon analogue of graphene. It holds significant promise for 2D electronic devices as, unlike graphene, it does have a small electrically tunable band gap.¹ So far, the most direct synthesis strategy has been to grow it epitaxially on metal surfaces;^{2,3} however, the effect of the strong silicon-metal interaction⁴ on the structure and electronic properties of the metal-supported silicene is generally poorly understood. Here, we consider the (4×4) -silicene monolayer (ML) grown on Ag(111), and show that our experimental results refute the common interpretation of this system as a simple buckled, honeycomb ML with a sharp interface to the Ag substrate. Instead, we demonstrate the pervasive presence of a second silicon species, concluded to be a Si/Ag alloy stacked between the 2D silicene and the silver substrate, as shown schematically in Figure 1. These findings question the current structural understanding of the silicene/Ag(111) interface and may raise expectations of analogous alloy systems in the stabilization of other 2D materials grown epitaxially on metal surfaces.

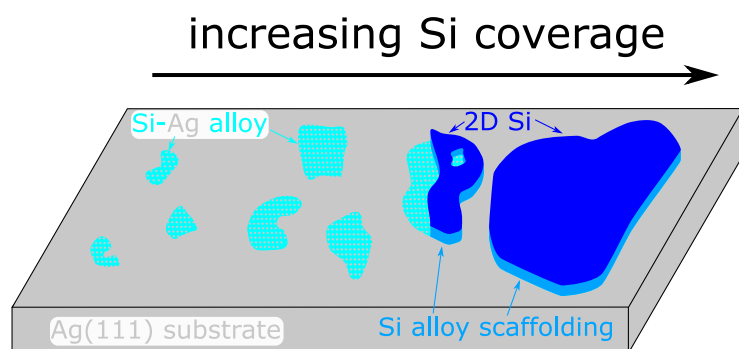


Figure 1: Schematic model of (4×4) -silicene growth. At low coverages, a Si-Ag surface alloy forms, providing the basis for 2D-Si growth at intermediate coverages. At high coverages, the surface is covered with 2D-Si, while the Si-Ag alloy persists, as scaffold for the stabilization of the 2D-Si.

References

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