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ABSTRACT:

Rising from the Sea of Atoms: Au-Induced Heterostructures on Silicon Surfaces

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Modern technology relies heavily on metal-semiconductor heterostructures, where their boundaries act as the working component of many electronic devices. Beyond the practical utility, these systems remain a focal point of fundamental research due to the diverse physical phenomena they exhibit. A prime example is the Au–Si system, which has been extensively studied for its deep eutectic temperature, its capability for metallic glass formation, surface crystallization above the equilibrium melting point, substrate-enhanced supercooling, catalyzed growth of Si nanowires or two-dimensional (2D) layers featuring exotic electronic characteristics [1].

Examples of such 2D Au-Si structures will be discussed. They include Si-Au structures formed at temperatures well below the eutectic temperature showing a plethora of surface atomic patterns [1], and planar silicene heterostructure risen at higher temperatures [2-5]. Special emphasis will be placed on the role of the substrate and its influence of the formation and characteristics of the Si-Au structures. Chemical functionalization will also be discussed [6,7]. These findings clarify the role of the Au-Si interface in stabilizing 2D allotropes, positioning these heterostructures as vital components for future electronic and energy storage device architectures.

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