Defects in Action: Real-time TEM observation of Nickel Silicide Propagation in Silicon Nanowires

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Nickel silicide nanowires (NWs) exhibit low resistivity, high structural stability, and excellent compatibility with silicon technology, making them highly attractive for use as interconnects in nanoelectronics [1,2]. In this study, we present a solution-based synthetic [3,4] approach to fabricate Sn-catalyzed, defect-rich silicon (Si) NWs grown from nickel (Ni) NW stems. This synthesis approach provides a unique platform to investigate the reaction kinetics and mechanistic understanding of silicide formation in more complex NW architectures.

To probe the transient dynamics of Ni silicide formation within these Si NWs, we employed *in situ* heating electron microscopy. Our real-time observations reveal varying degrees of non-uniform silicide formation depending on the NW morphology, surface conditions, and crystallographic defects. Furthermore, we captured the process of interfacial segregation in the Ni silicide system, induced by the nanowire catalyst. These results provide new insights into defect-mediated metal diffusion and phase transformation in NW systems, offering crucial guidance for the design, optimization, and reliability of silicide-based nanodevices [5].

References

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