

Undoped Si/SiGe and Ge/GeSi heterostructures for spin applications

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Abstract

Two-dimensional systems in Si/SiGe and Ge/GeSi heterostructures have been the main topics for quantum physics for decades. Si-based quantum dot quantum computing was demonstrated on a two-dimensional electron gas (2DEG) platform in an undoped Si/SiGe heterostructures with top gating. Unlike the conventional modulation-doped heterostructures, gate leakage and dopant fluctuations leading to device instability are much suppressed in undoped heterostructures. On the other hand, strong spin-orbit interaction (SOI) was discovered in two-dimensional hole gases (2DHGs) by Ge/GeSi heterostructures. All-electric group-IV spin FETs can be realized on the Ge/GeSi heterostructure platform. In this talk, material growth and transport properties of 2DEGs and 2DHGs in undoped Si/SiGe and Ge/GeSi heterostructures will be introduced with unique surface tunneling in undoped structures also reported. Preliminary results on SOI in undoped Ge heterostructures will be presented.