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Epitaxial growth of ^{28}Si enriched *in situ* to 99.9998% for quantum information KEVIN DWYER, MSE, University of Maryland, College Park, JOSHUA POMEROY, DAVID SIMONS, National Institute of Standards and Technology — In support of quantum information devices, we epitaxially deposit >100 nm ^{28}Si films enriched *in situ* to >99.9998 % isotope fraction at high temperature. Using our silicon enrichment ion beam deposition source, we explore electrical and structural properties of our ^{28}Si films using *in situ* reflection high energy electron diffraction (RHEED), transmission electron microscopy (TEM) and electrical measurements including capacitance–voltage profiling. Secondary ion mass spectrometry (SIMS) is used to show ^{28}Si films have residual ^{29}Si isotope fractions <1 ppm (40 times less than previously reported ^{28}Si sources). We also demonstrate the ability to produce isotope heterostructures with applications including ^{28}Si/^{28}Si^{74}Ge quantum wells. ^{28}Si is a critical material for quantum computing as removal of ^{29}Si spins means qubits such as phosphorous atoms can have nuclear coherence (T_2) times of minutes even up to room temperature and can be addressed optically due to hyperfine transitions not normally resolvable in natural Si. Despite these advantages, ^{28}Si is quite scarce making it clear that an alternate source such as the one we demonstrate is needed.

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