Epitaxial growth of $^{28}\text{Si}$ enriched \textit{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 $^{28}\text{Si}$ films enriched \textit{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 $^{28}\text{Si}$ films using \textit{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 $^{28}\text{Si}$ films have residual $^{29}\text{Si}$ isotope fractions <1 ppm (40 times less than previously reported $^{28}\text{Si}$ sources). We also demonstrate the ability to produce isotope heterostructures with applications including $^{28}\text{Si}/^{28}\text{Si}^{74}\text{Ge}$ quantum wells. $^{28}\text{Si}$ is a critical material for quantum computing as removal of $^{29}\text{Si}$ 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, $^{28}\text{Si}$ is quite scarce making it clear that an alternate source such as the one we demonstrate is needed.