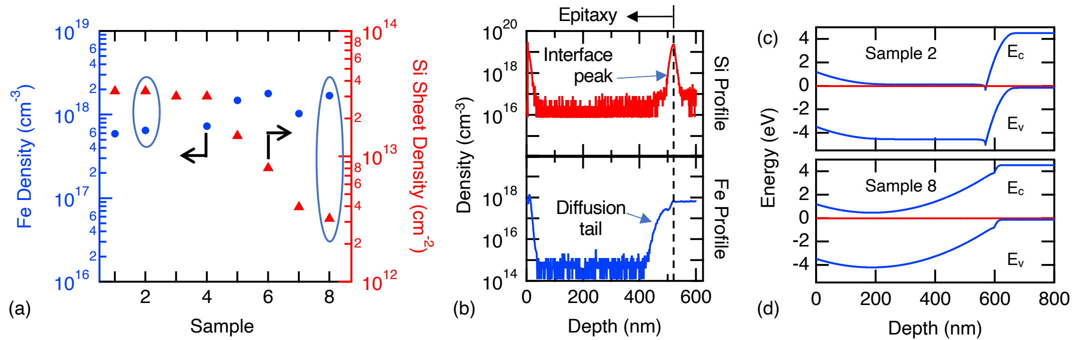

Fig. 1 (a) The average Fe density within the substrate for 8 different samples is shown (blue circles) and the sheet density of the interfacial Si peak is plotted (red triangles) for 8 different samples. The circled samples (sample 2 and 8) are studied further in the following panels. (b) The Si and Fe SIMS profiles are shown for sample 2. (c) and (d) Show the simulated band diagram. Sample 2 is shown in (c) and sample 8 is shown in (d). The Si and Fe densities are such that in sample 2, the conduction band is pulled below the E_f, (c), while in sample 8 the conduction band remains above the E_f.

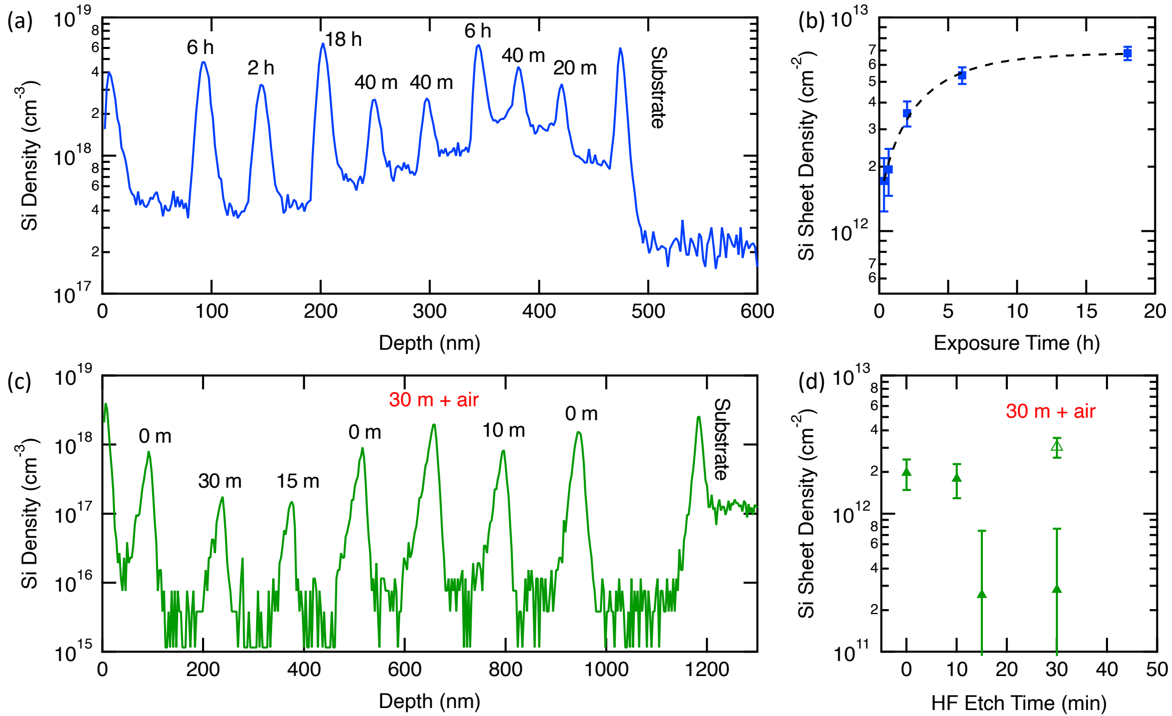

Fig. 2 (a) An unintentionally doped (UID) sample was grown by molecular beam epitaxy. The sample was removed and exposed to air for a predetermined amounts of time to allow Si to accumulate, and then the sample was returned to the growth chamber where another UID layer was grown to protect the previously exposed surface. This was repeated 8 times. The exposure time is listed above the peak and ranged from 20 minutes to 18 hours. (b) The Si peaks in (a) were integrated to determine a sheet density which is plotted as a function of the exposure time. After ~8 hours the Si sheet density begins to saturate to a value of $\sim 7\times10^{12}/cm^2$. (c) and (d) show our efforts to remove the Si. UID layers were again grown, this time by metalorganic vapor-phase epitaxy. All layers within the stack were exposed to air for 2-hours (based on the results in panel (a)). Then the sample was etched in HF (49%). The etch time was varied from 10 minutes to 30 minutes, along with 3 control layers where no etching was performed. (d) shows the sheet density obtained by integrating the peaks shown in (c). After a 15-minute HF etch, the sheet density is reduced by ~ 1 order. Lastly, to understand how quicky Si re-accumulated on the surface, a 30-minute HF etch was performed after the initial 2-hour air exposure. After the HF etch, the sample was left in air for 10 minutes (open triangle with label). After 10-minutes, the Si has fully returned, indicating that the sample must be quickly moved to the growth chamber. Note, there is an additional 1.5 to 2 minutes for each step, as the sample is transferred to the growth chamber and pumped down.