

Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Interaction of PH₃ with Si(111)-7x7 Surfaces: Adsorption, Desorption and P-segregation.¹ T.-C. SHEN, JEONG-YOUNG JI, Utah State University — The reaction of PH₃ with Si(111) surfaces has been studied in the early 1990s by a number of analytical techniques including UPS, AES, EELS and ESD. We are interested in revisiting this system with an emphasis on P-delta layers formation for their potential technological applications. Here we present a STM study of PH₃ adsorption on Si(111)-7x7 at 300 K and 900 K. Reacted and unreacted adatom sites after room temperature exposures can be identified by different biases. Similar to the ammonia adsorption the center adatoms are more reactive than corner adatoms. A careful analysis of the surface coverage of PH₃, PH₂, and H, we conclude that most of PH₃ is dissociatively adsorbed on the surface at initial exposure generating H and PH₂ adsorption sites followed by molecular adsorption of PH₃. More interestingly, a quasi-regular $6\sqrt{3}$ surface structure forms by PH₃ exposure at 900 K. The dangling bonds of Si(111)-1x1 are completely terminated by a layer of P atoms. No epitaxial Si can be grown on this surface at low temperatures. Annealing the Si covered surface to 900 K recovers the $6\sqrt{3}$ structure due to P segregating to the surface. Short heat pulses were used to find that P desorbs at 950 K but 7x7 domain was not observed until 1070 K.

¹This work is supported by NSF-NIRT-CCF0404208

T.-C. Shen
Utah State University

Date submitted: 20 Nov 2006

Electronic form version 1.4