

InP, InGaAs, and InAlAs Dry Etch using Unaxis ICP Etcher (PM1)

Experimental (8-31-2015):

- 1) O₂ plasma PM1 chamber clean: 15 minutes.
- 2) PM1 chamber coating with a quarter of InP wafer (2"): 15 minutes (1.4mT, 125/800W, Cl₂/H₂/Ar=5/14/5 sccm).
- 3) InP etch test (InP#1510): 1.4mT, 125/800W, Cl₂/H₂/Ar=5/14/5 sccm, and time=90 s. After that, I took some SEMs .
- 4) Sample (from an external user) etch (needs to etch: 4.15um of InP, 0.7um of InGaAs, and 1.54um of InGaAs/InAlAs superlattice): 1.4 mT, 125/800W, Cl₂/H₂/Ar=5/14/5 sccm, and time=432 s. The result: the total depth including remaining etch mask (~0.3um) was 8.71um.
- 5) InP etch test again (InP#1511): 1.4mT, 125/800W, Cl₂/H₂/Ar=5/14/5 sccm, and time=90 s. After that, I took some SEMs again.
- 6) O₂ plasma PM1 chamber clean: 15 minutes.
- 7) PM1 chamber coating with a quarter of InP wafer (2"): 15 minutes (1.4mT, 125/800W, Cl₂/H₂/Ar=5/14/5 sccm).
- 8) InP etch test (InP#1512): 1.4mT, 125/800W, Cl₂/H₂/Ar=5/14/5 sccm, and time=90 s. After that, I took some SEMs .

SEM Result:

Figure 1 (a) InP etch profile of InP#1510 before etching UW sample with etch rate of $\sim 1.19 \mu\text{m}/\text{min}$.; (b) InP etch profile of InP#1511 after etching UW sample with etch rate of $\sim 1.54 \mu\text{m}/\text{min}$. The rate increases 29.6% $[(1.54-1.19)/1.19]$.

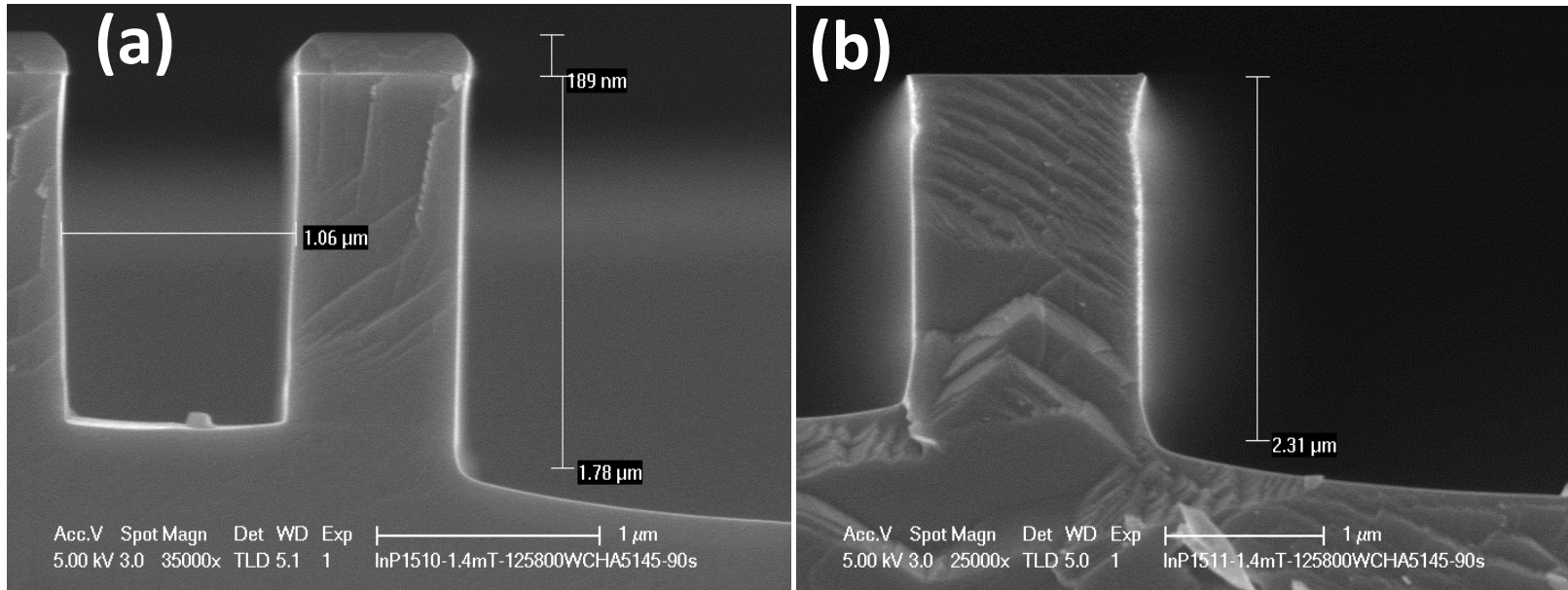
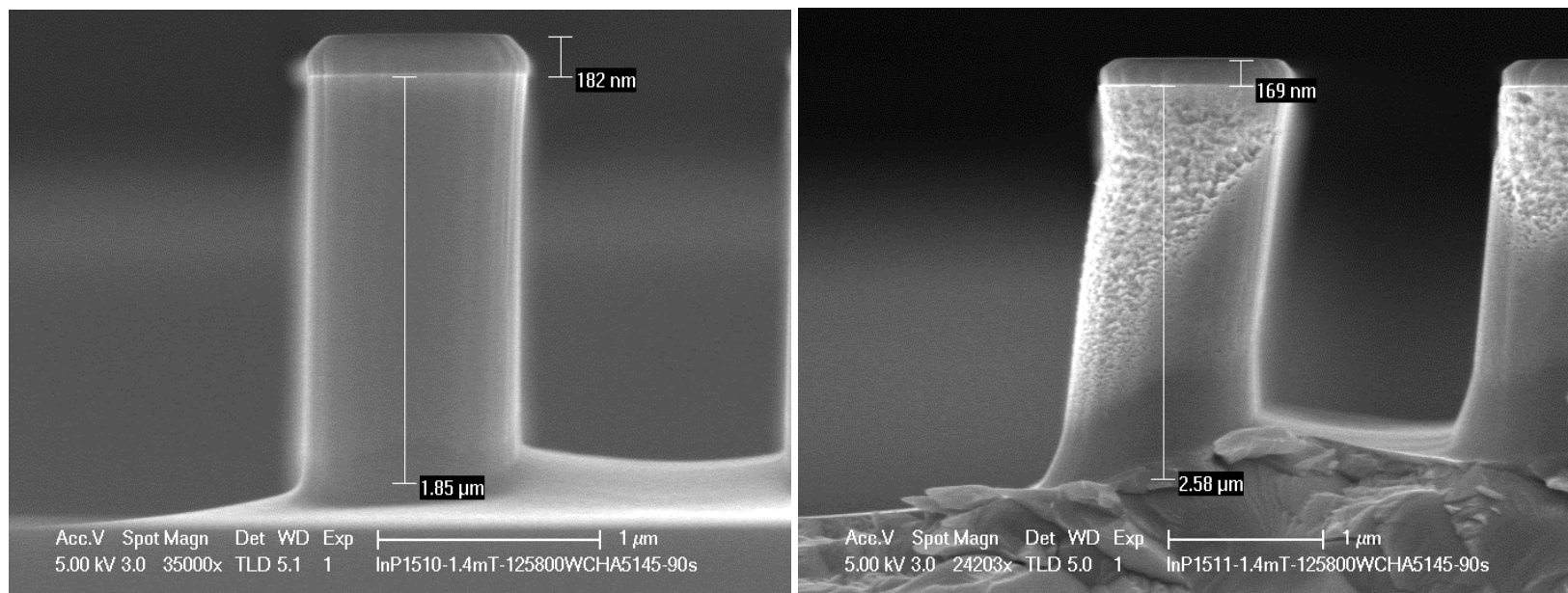
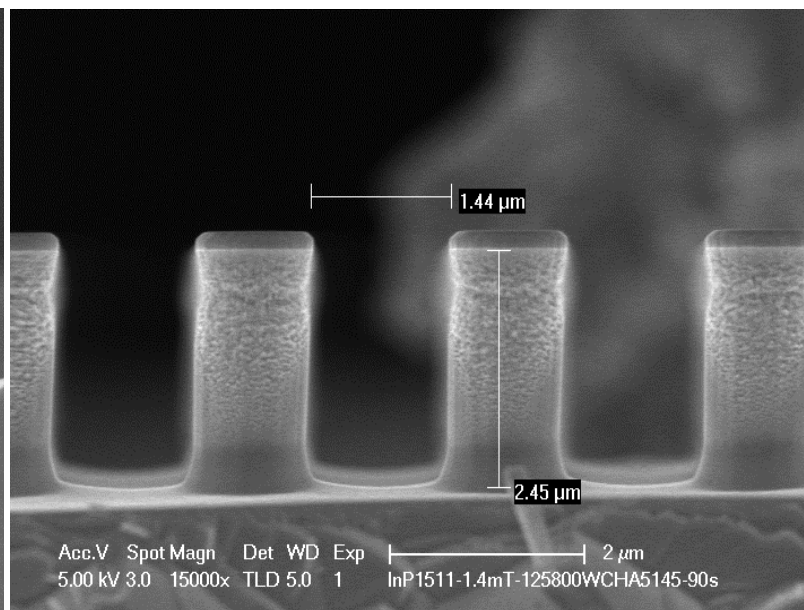
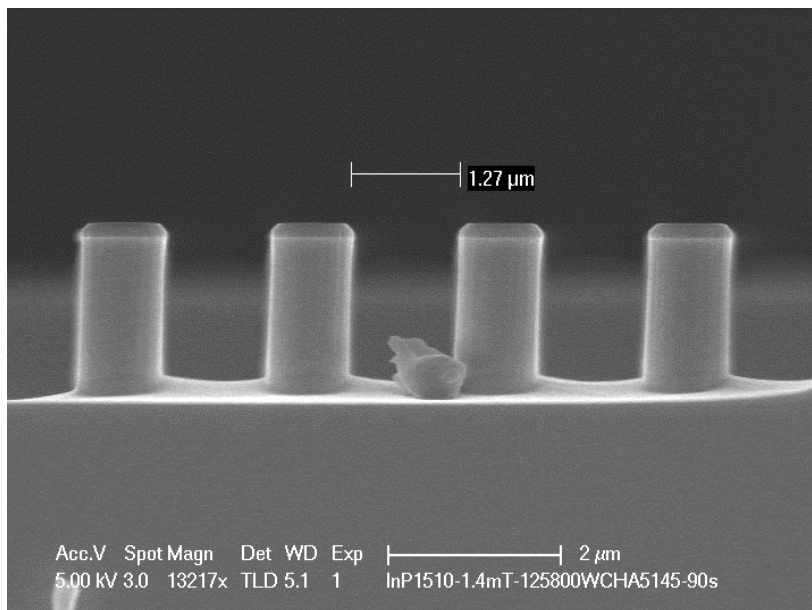


Figure 2 Left Column: InP etch profile of InP#1510 before etching UW sample and the etched surface is smooth; Right column: InP etch profile of InP#1511 after etching UW sample and the etched surface is rougher.





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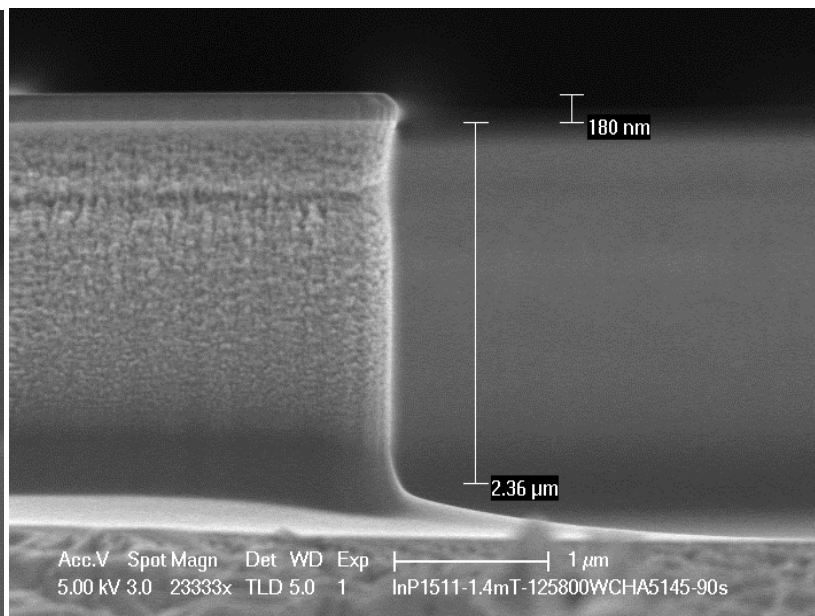
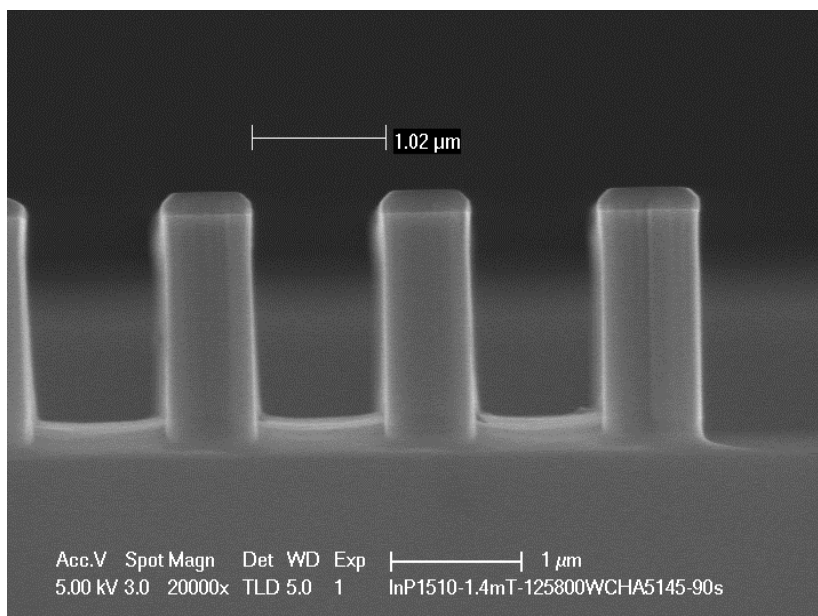


Figure 3 Etch profile of InP#1512 after O₂ plasma clean and Cl₂/H₂/Ar plasma coating of the chamber. The etch rate is 1.2 $\mu\text{m}/\text{min}$.

