

InP Grating Etches

Oxford PlasmaPro 100 Cobra 300

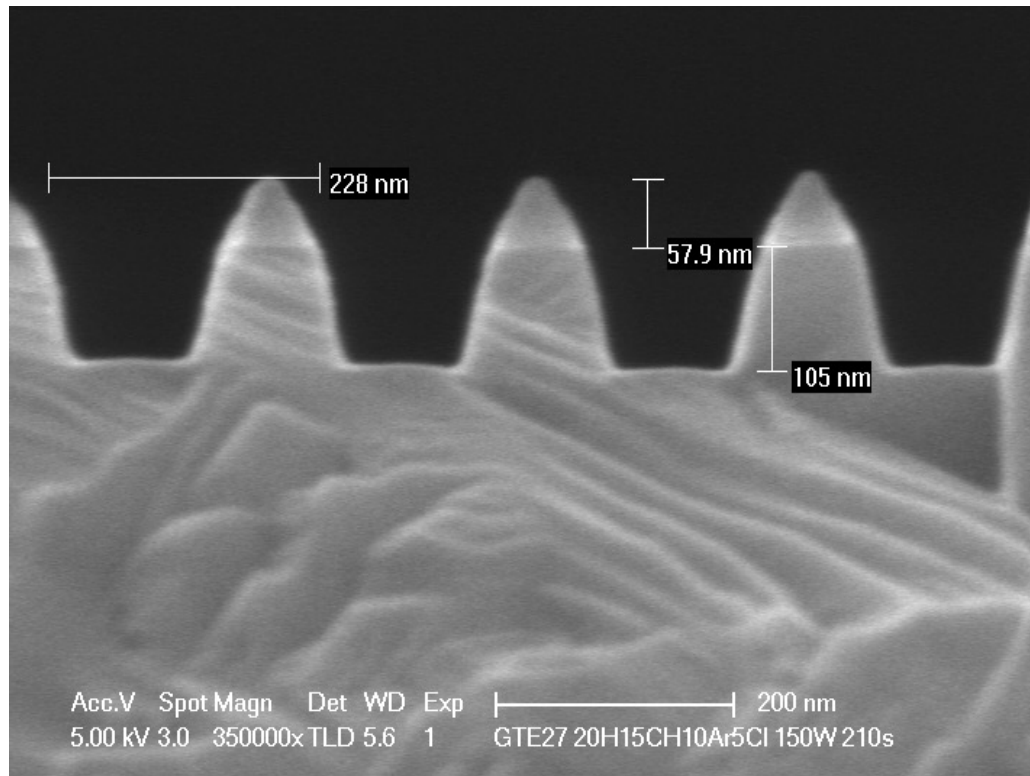
Ning Cao
2021-08-26

The “standard” InP Grating recipe:

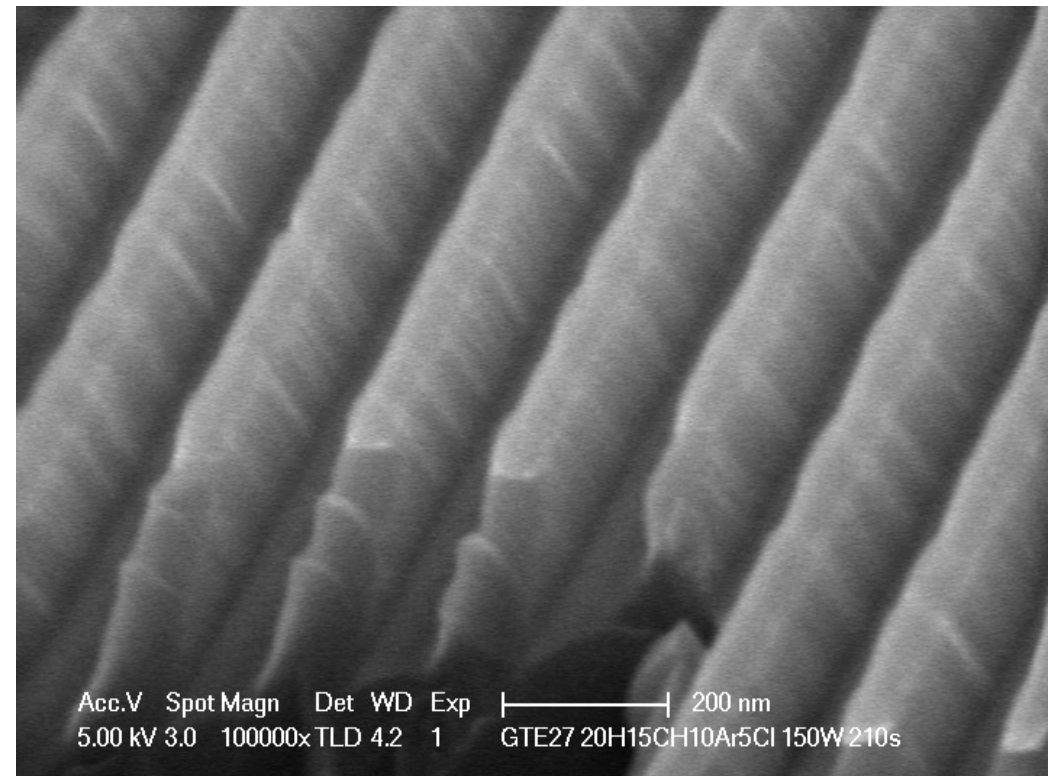
“Std InP Grating Etch - Cl₂/CH₄/H₂/Ar 20C”

2mT, RF=150W/ICP=100W; CH₄=15/H₂=20/Ar=10/Cl₂=5 sccm; 3.5 min

**Sample from #4A, Etch rate=29.4
nm/min, sidewall angle=77.7 degree**



Bottom surface is smooth



Recipe Variations in following slides

- Development process – 30 etches performed to achieve best result
- Targeting:
 - Slightly non-vertical grating sidewall, for regrowth
 - no micro-trenching
 - Smooth etched surfaces (no pillars/micromasking etc.)

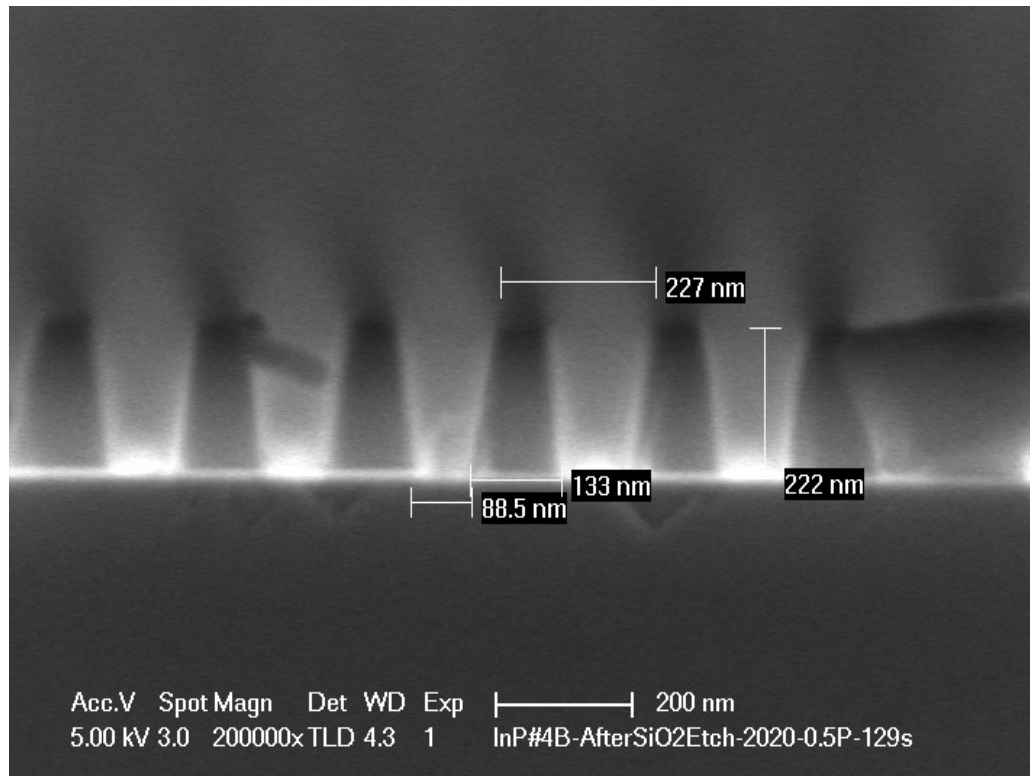
InP Grating Etch at 20 C, PlasmaPro 100 Cobra

InP pieces

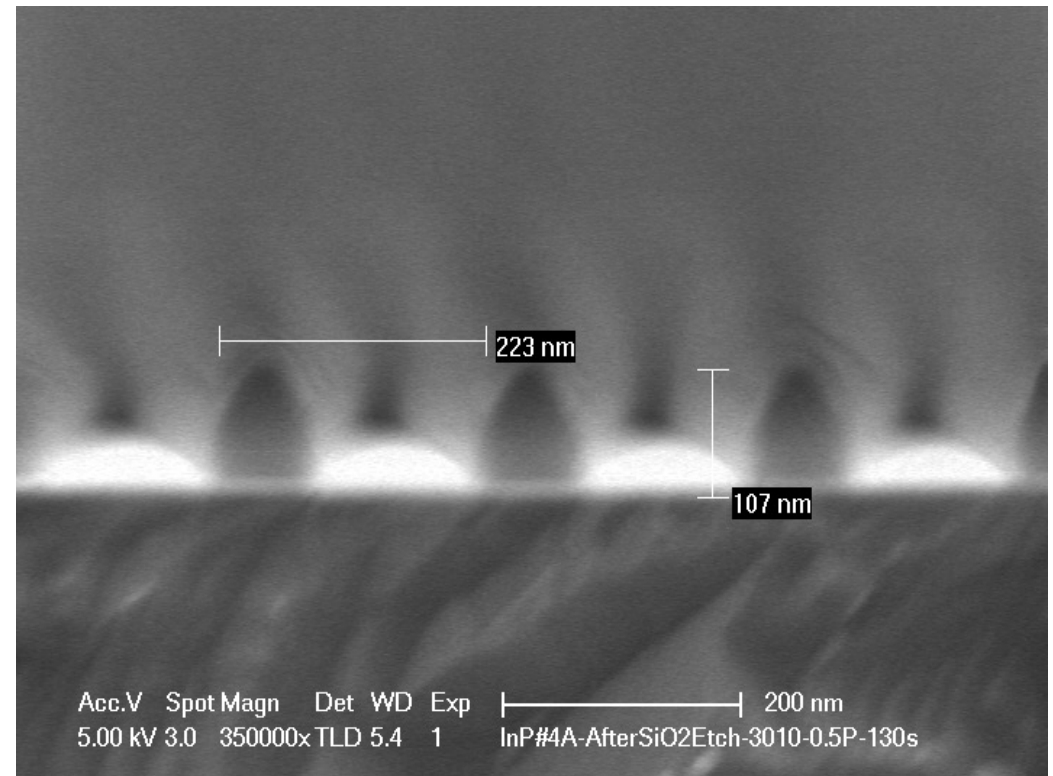
SiO₂ Hardmask patterned by Holography

100mm Silicon carrier wafer, no adhesive, rough side up

Grating Pattern (Holography and SiO₂ Etch) Quarter#4B

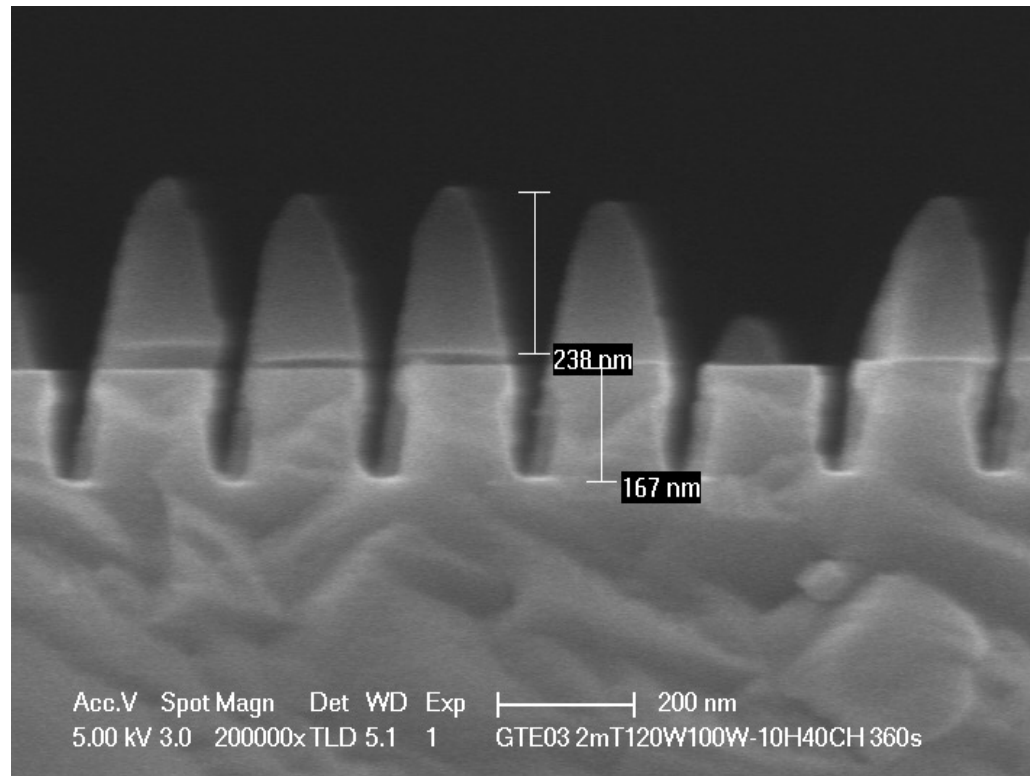


Grating Pattern (Holography and SiO₂ Etch) Quarter#4A

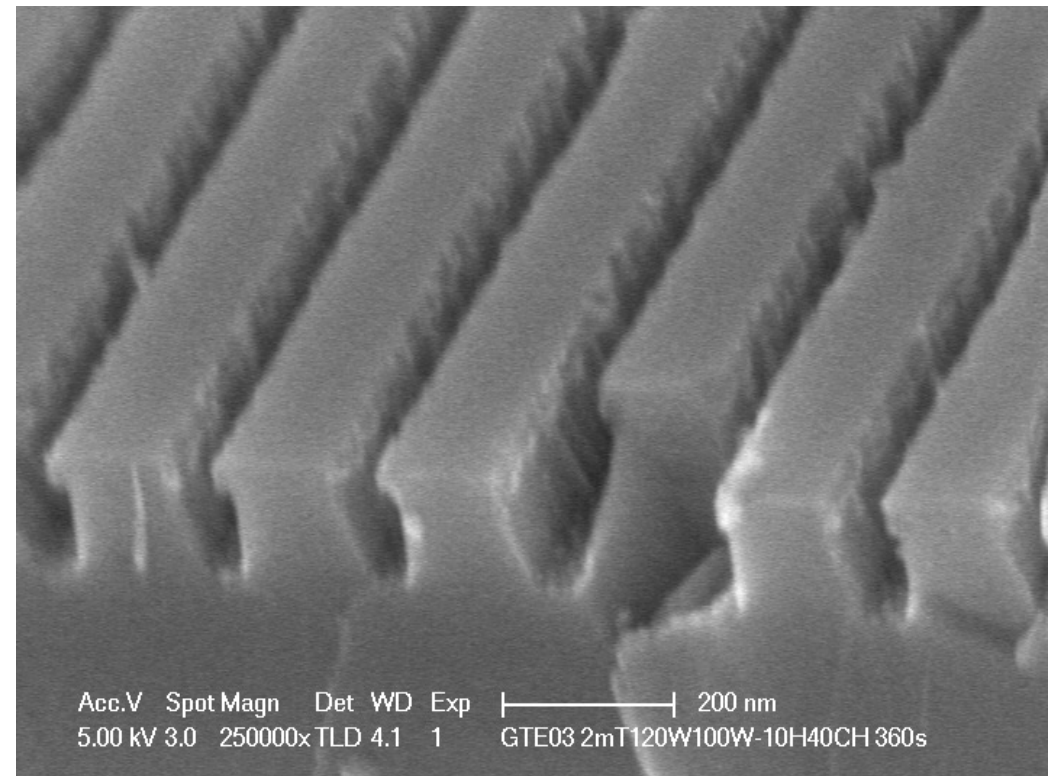


Oxford Recipe: 2mT, CH₄/H₂=40/10 sccm,
120W(Bias)-100W(ICP), 6 min

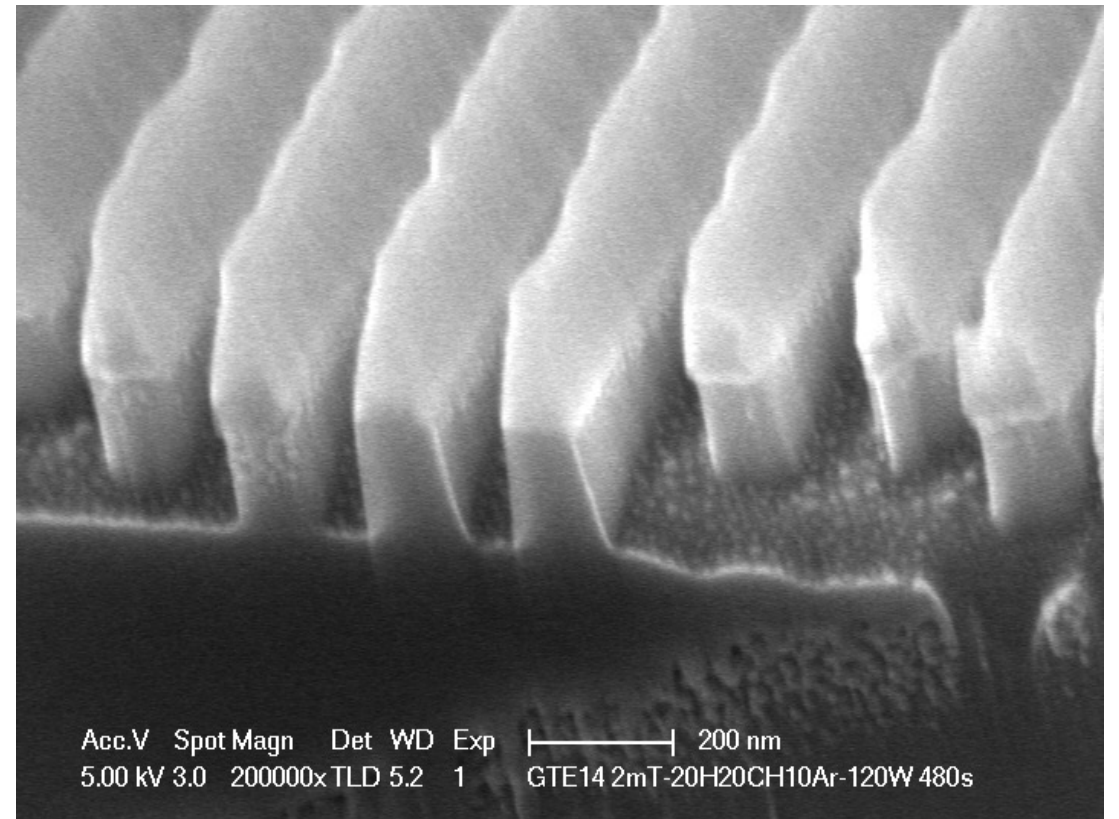
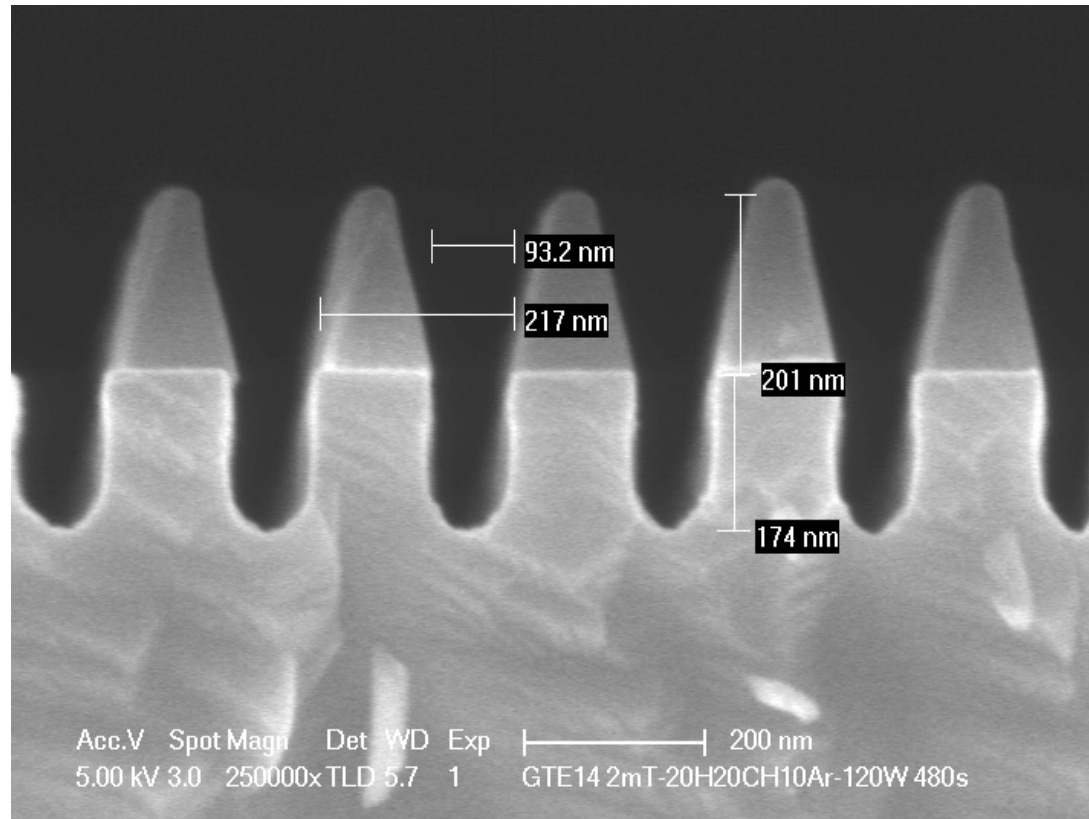
Using #4B



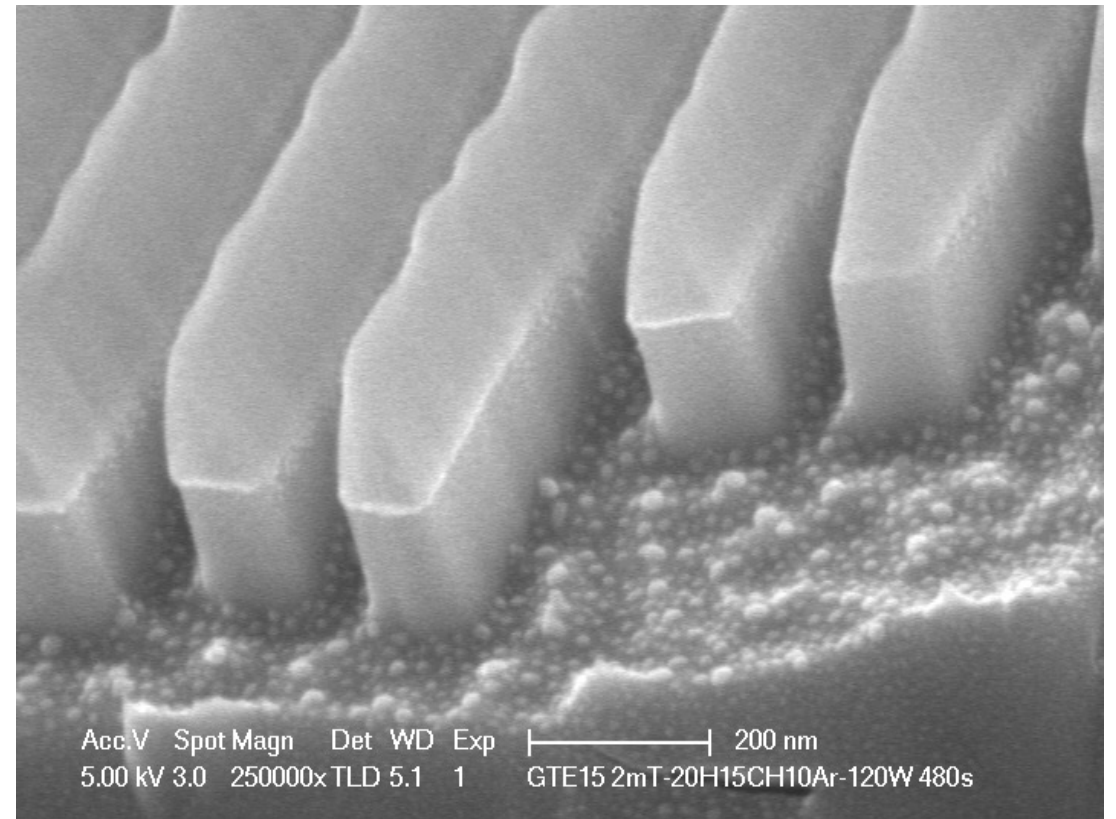
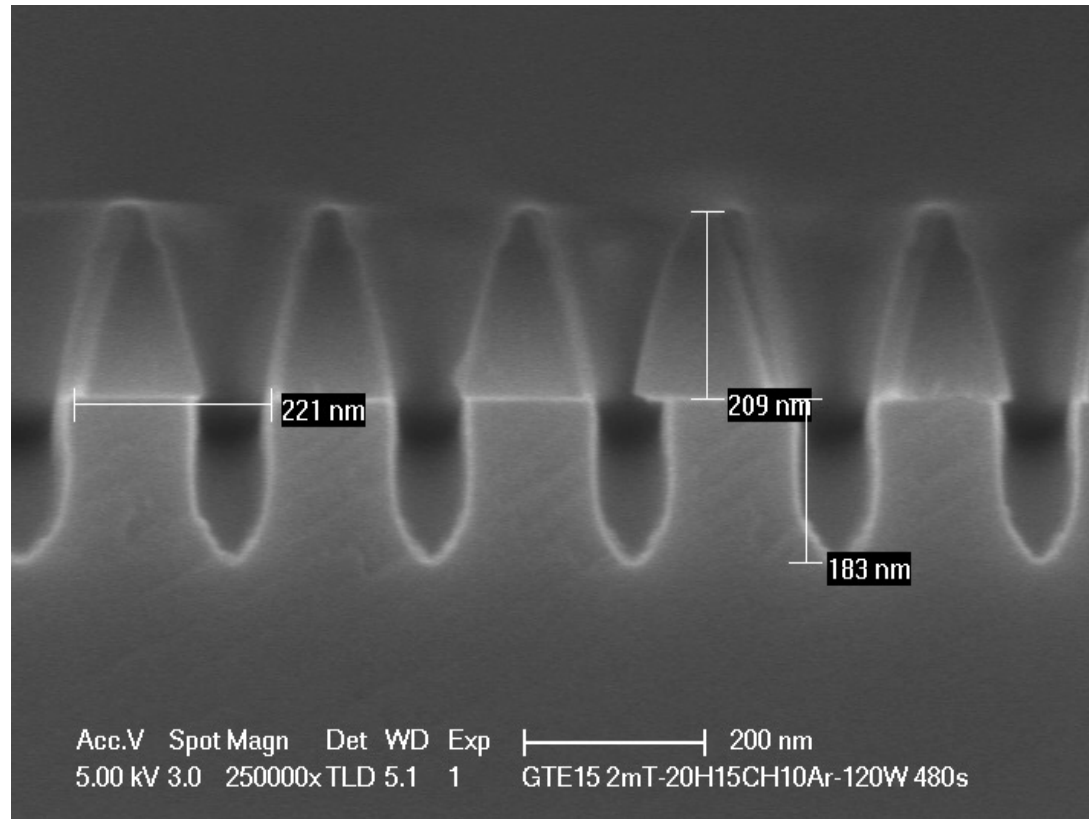
Issue: too much CH₄, and polymer built up



Reducing CH4: 2mT, 120W-100W,
CH4/H2/Ar=20/20/10 sccm, 8 min

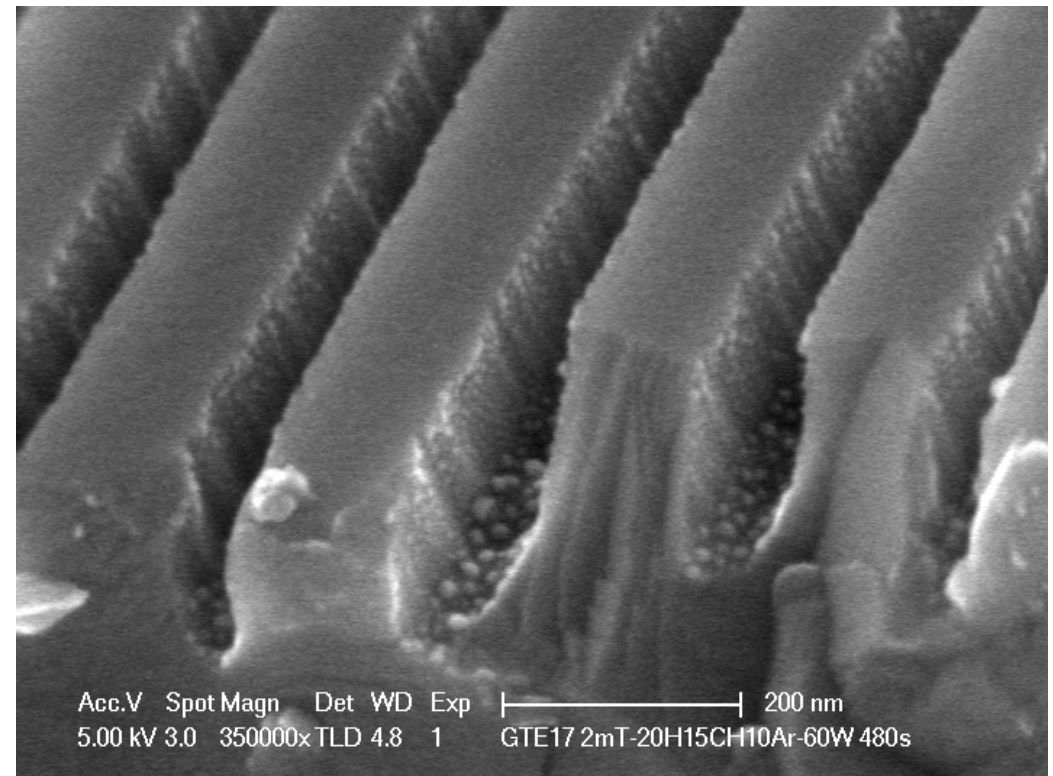
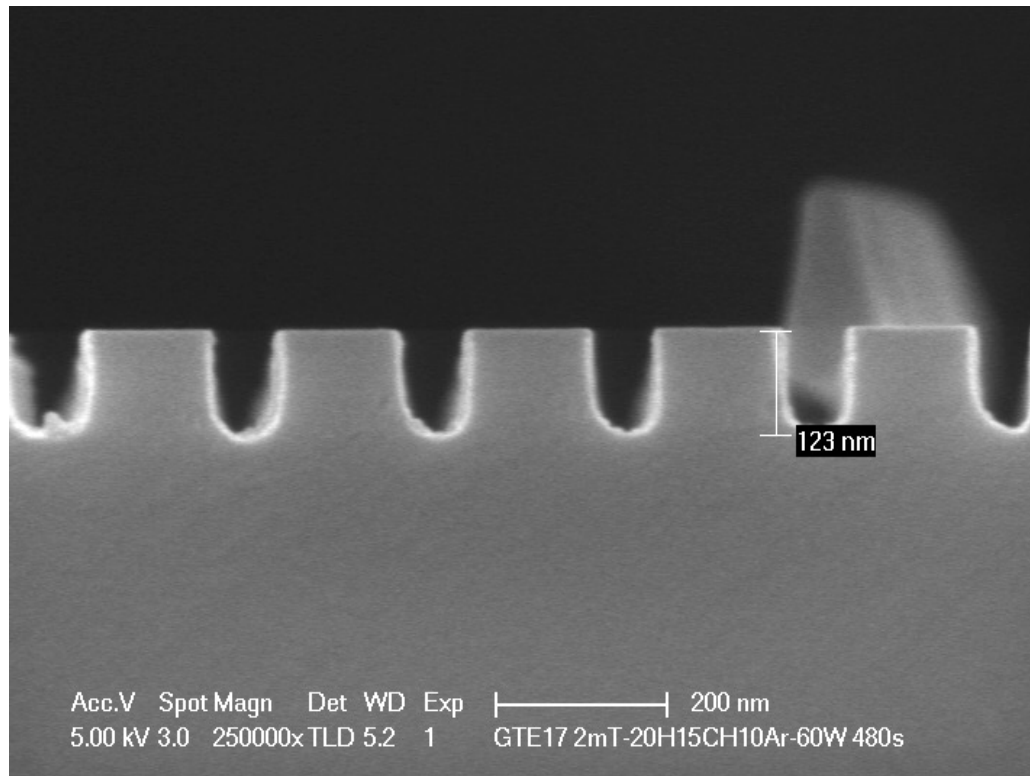


Further Reducing CH4: 2mT, 120W-100W,
CH4/H2/Ar=15/20/10 sccm, 8 min



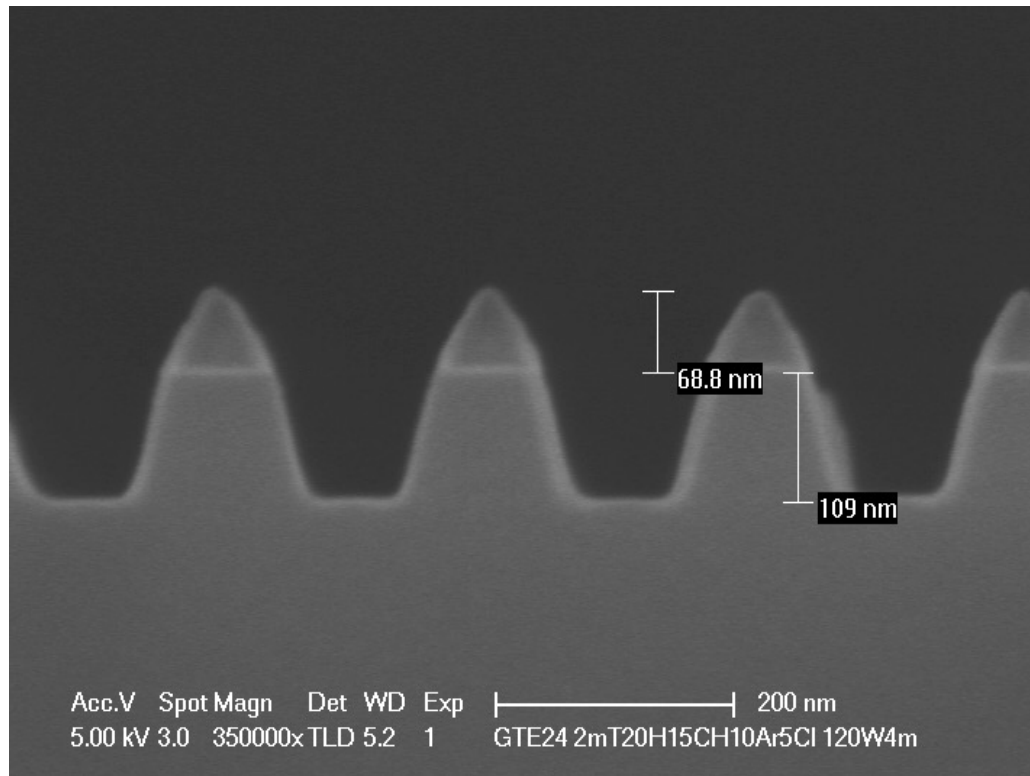
Reducing Bias: 2mT, 60W-100W,
CH₄/H₂/Ar=15/20/10 sccm, 8 min

The bottom roughness still there!

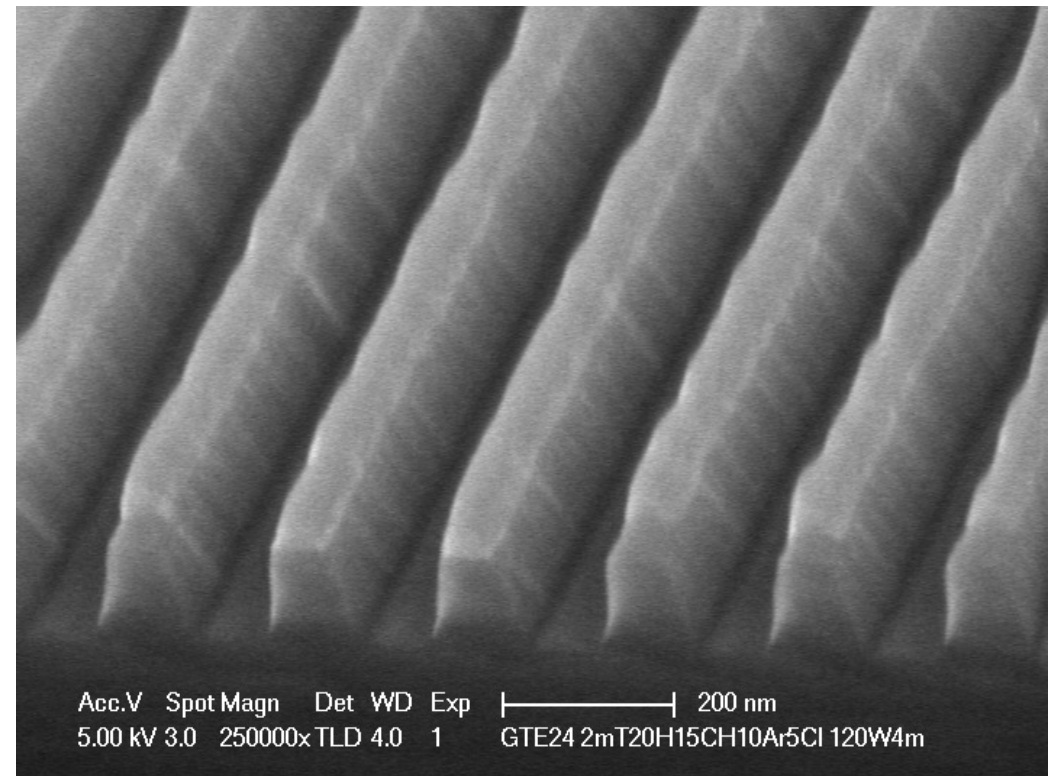


Adding Cl₂: 2mT, 120W-100W,
CH₄/H₂/Ar/Cl₂=15/20/10/5 sccm, 4min

Sample from #4A, Etch Rate=27.6
nm/min, sidewall angle=74.4 degree



Bottom roughness gone!



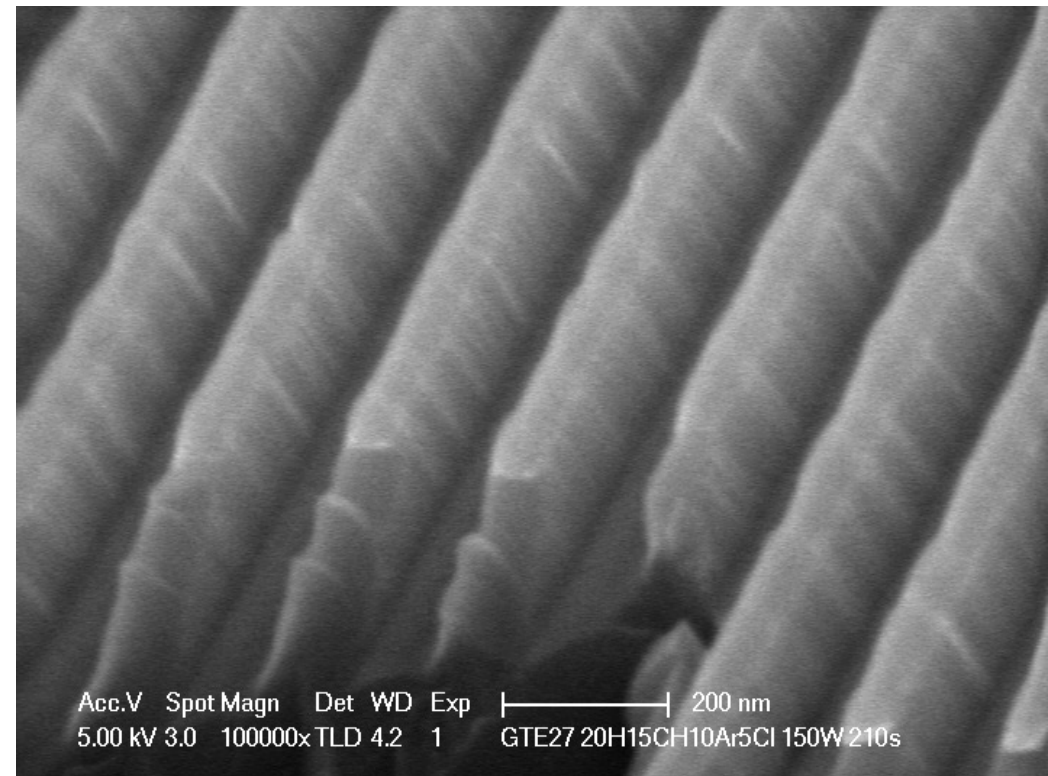
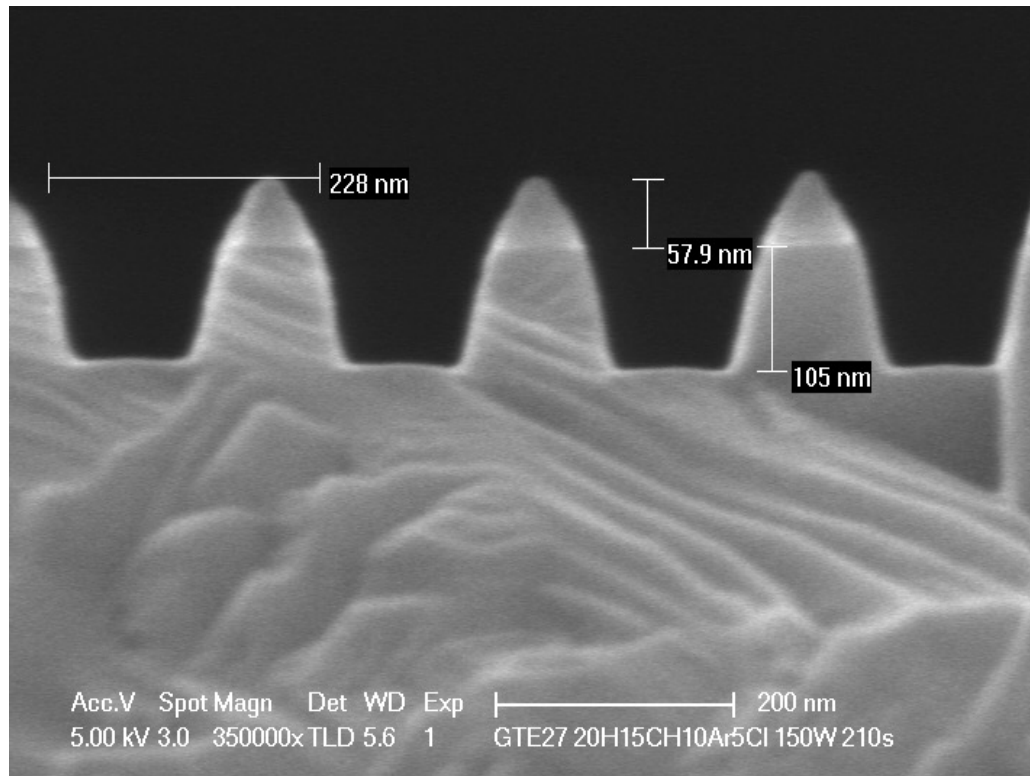


This is the "standard" InP Grating recipe

Increasing Bias: 2mT, 150W-100W
CH₄/H₂/Ar/Cl₂=15/20/10/5 sccm, 3.5 min

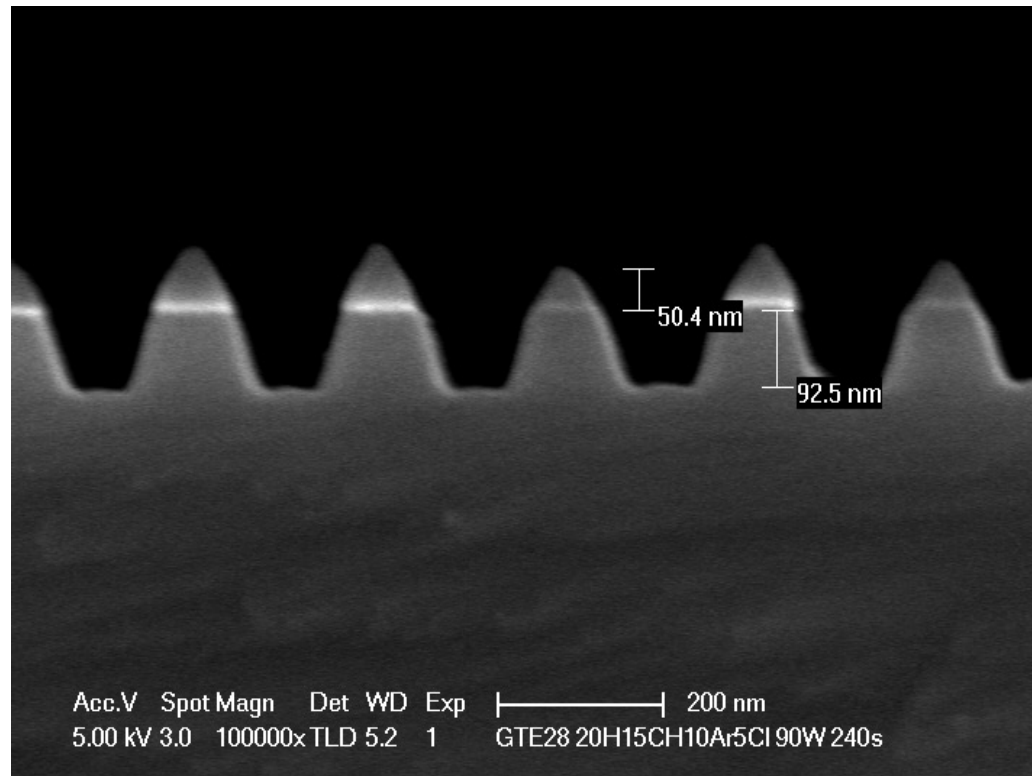
Sample from #4A, Etch rate=29.4
nm/min, sidewall angle=77.7 degree

Bottom roughness gone!



Decreasing Bias: 2mT, 90W-100W,
CH₄/H₂/Ar/Cl₂=15/20/10/5 sccm, 4 min

Sample from #4A, Etch Rate=24.3
nm/min



Bottom roughness gone!

