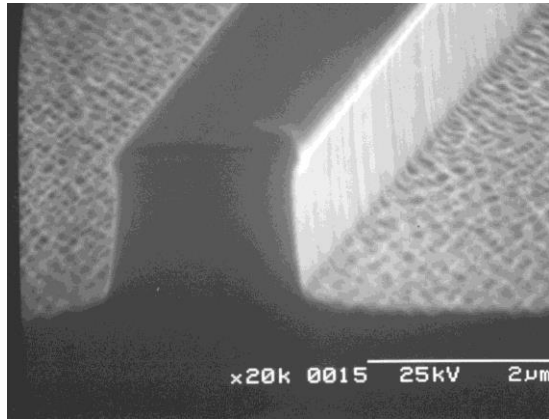


## InGaAsP Mesa Etching

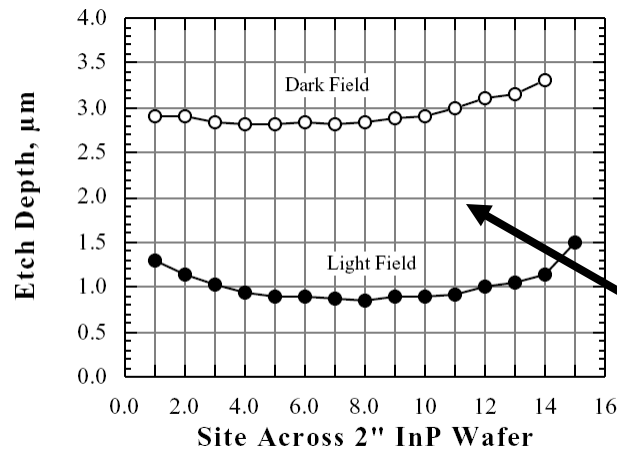


(E. Skogen)

Polymer formation on sidewall leads to vertical profile

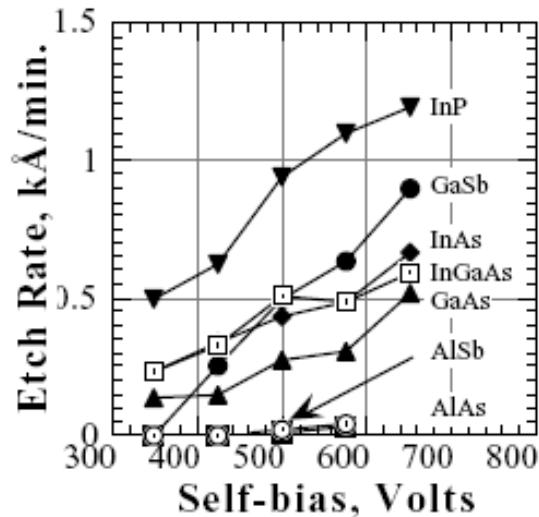
## Recipe for Etching InP/InGaAsP mesa

- Base pressure (5 e-6 Torr)
- 50 C electrode temp.
- CH<sub>4</sub>/H<sub>2</sub>/Ar 4/20/10 sccm
- 75 mT etch pressure
- -450 V Sample Bias
- Etch Rate ~ 43 nm/min (1/4 of 2" wafer)
- SiN Mask (Si, SiO<sub>2</sub> masks OK. PR masks not OK)
- Post Clean Cycle to remove polymer
  - O<sub>2</sub> 20 sccm
  - 125 mT pressure
  - -300 V Sample Bias
  - 5 minutes

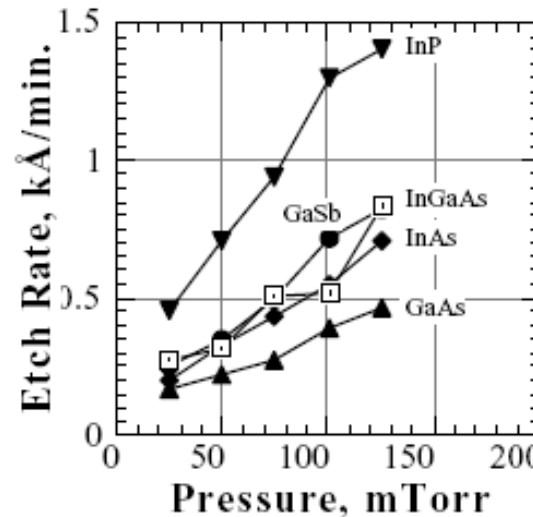


(J. Schramm : Loading Effect)

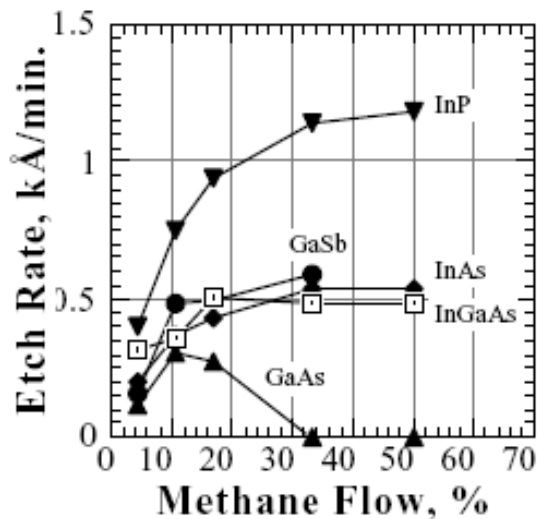
Dark Field : Very small open area  
 Light Field: Whole 2" wafer  
 Effect not linear with area! Full loading at less than 2" wafer



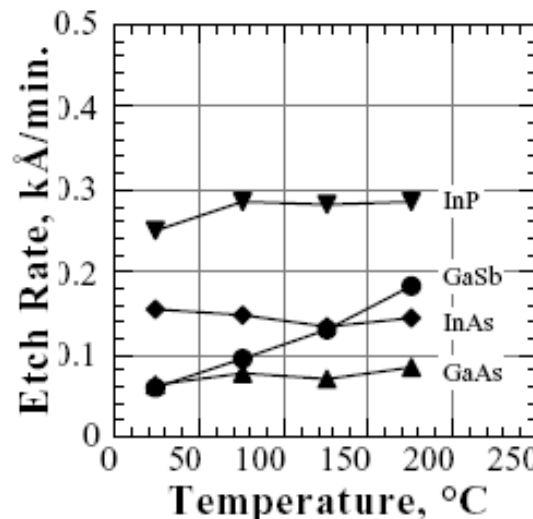
(a)



(b)



(c)



(d)

(Data: J. Schramm)

Very small open area: Dark-Field result

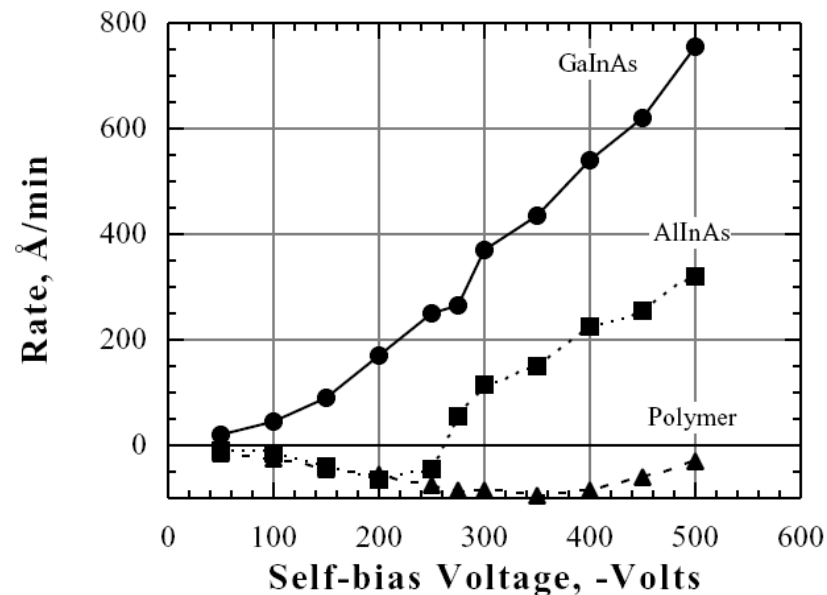
Etch rates of various compound semiconductors in methane/hydrogen/argon versus (a) RIE self-bias voltage, (b) pressure, (c) concentration, and (d) temperature.

The parameters were varied about 4 sccm CH<sub>4</sub>, 20 sccm H<sub>2</sub>, 10 sccm Ar, 75 mTorr, 500 Volts, and room temperature, except for (d), which was done at 10 mTorr without Ar.

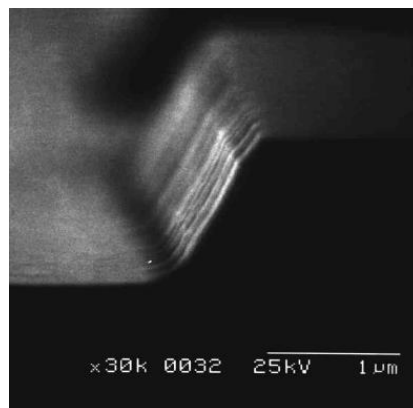
## Recipe for Etching AllnAs/InGaAs mesas (lattice match to InP)

- 50 C electrode temp.
- CH<sub>4</sub>/H<sub>2</sub>/Ar 4/20/10 sccm
- -450 V Sample Bias
- 75 mT pressure for GaInAs, Rate ~ 30 nm/min.
  - 1/4 of 2" wafer, light field
- 110 mT for AllnAs, Rate ~ 3.5 nm/min.
  - 1/4 of 2" wafer, light field
- SiN Mask (Si, SiO<sub>2</sub> masks OK. PR masks not OK)
- Oxygen cycling after every 4.5 min etching (AllnAs) No cycle for InGaAs
  - O<sub>2</sub> 50 sccm
  - 125 mT pressure
  - -180 V Sample Bias
  - 1.3 minutes

(Data: J. Schramm)

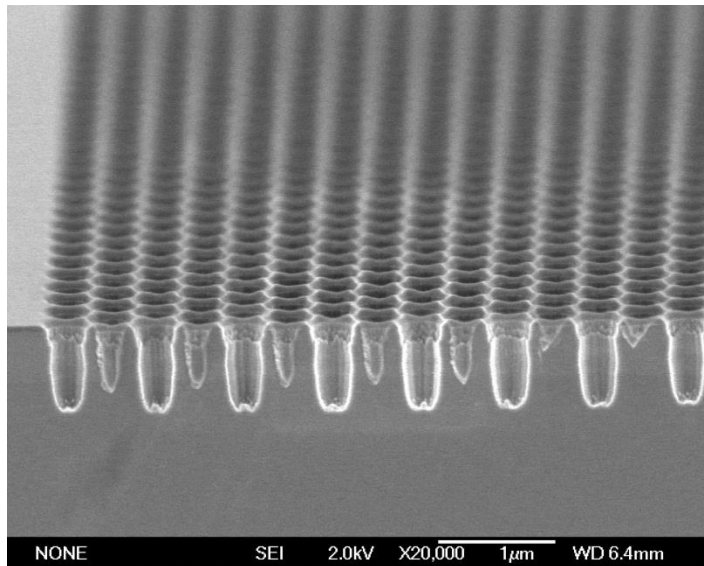


(125 mTorr, 4/20/10 sccm MHA)  
Small Open Area: Dark Field



AllnAs, 500V

## InGaAsP Photonic Crystal



(A. Xing)  
Very Small Open Area: Dark Field

## Recipe for Etching Narrow Holes InGaAsP

- Base pressure (5 e-6 Torr)
- 50 C electrode temp.
- CH<sub>4</sub>/H<sub>2</sub>/Ar 4/20/10 sccm
- 75 mT etch pressure
- -500 V Sample Bias
- Etch Rate ~ 80 nm/min (Very small open area)
  - 300 nm wide holes
- SiN Mask (Si, SiO<sub>2</sub> masks OK. PR masks not OK)
- Oxygen cycling after every 2.0 min etching
  - Required for submicron work
  - O<sub>2</sub> 50 sccm
  - 125 mT pressure
  - -180 V Sample Bias
  - 1.0 minutes