High Aspect Ratio Si Pillars Etch

Pillar Diameter: 1.0-1.5μm
Etching Mask: 50 nm Al

Process Condition

Parameter	Value
C_4F_8 (sccm)	160
SF_6 (sccm)	70
Pressure (mTorr)	20
Coil Power (W)	1200
Platen Power (W)	12
Temperature (°C) (lid/wall/chuck)	40/40/21

Result

Etch Rate (μm/min)	0.17
Etch Profile	89.5°
Selectivity to Al	>100:1

Note: Profile = $\tan^{-1}(2H/(D_b - D_t))$,
H: etch depth, D_t = top diameter, D_t = bottom diameter
Selectivity = etch rate of Si/etch rate of Al

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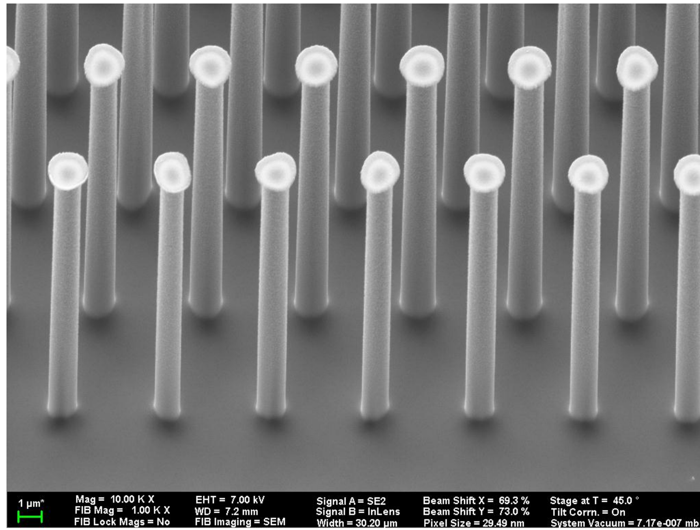
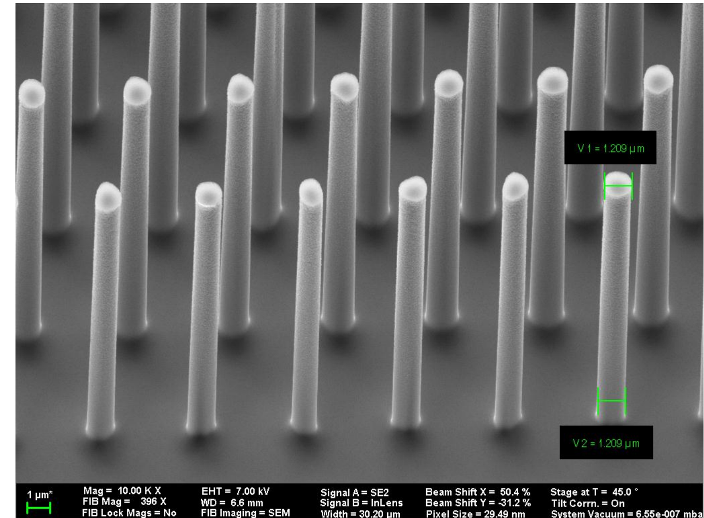


10µm in depth and 1.2-1.5 µm in diameter Si pillars, before Al mask was removed



After Al mask was removed

Si Nano-Wires and Nano-Needles

Mask: 0.05 µm Al

RIE Etch Conditions:

C4F8: 160 sccm
SF6: 70sccm
Pressure: 20 mTorr
Coil power: 1200 W
Platen power: 12 W
Temperatures: lid/wall/chuck = 40/40/21 °C

Wet Thermal Oxidation:

Temperature: 1000 °C
Time: variable, depend on how much Si to be removed

Vapor HF Etch:

Temperature: room
Time: Variable

Results:

Etch rate = 0.17 µm /min
Etch profile = 89.5°
Selectivity >100:1