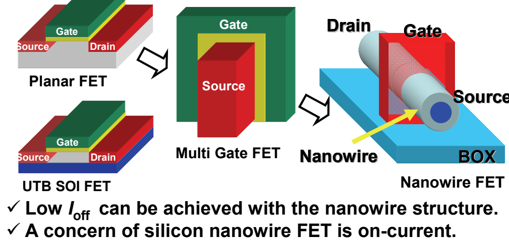
Influence of the cross-sectional shapes for Si Nanowire FETs

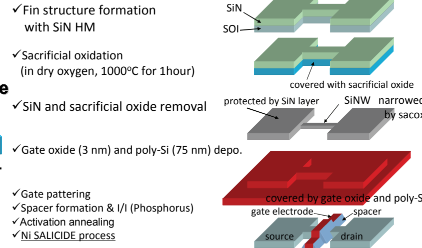
S. Sato[1], K. Kakushima[2], P.Ahmet[1],
K. Ohmori[3], K. Natori[1], K. Yamada[3], and H. Iwai[1]
Tokyo Tech. FRC[1], Tokyo Tech. IGSSE[2], University of Tsukuba[3]

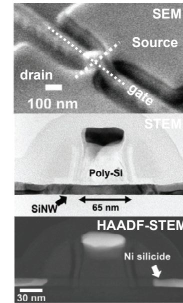
Introduction



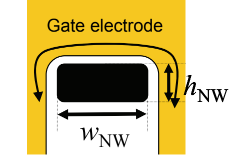
✓ Low I_{off} can be achieved with the nanowire structure.
✓ A concern of silicon nanowire FET is on-current.

Device Fabrication



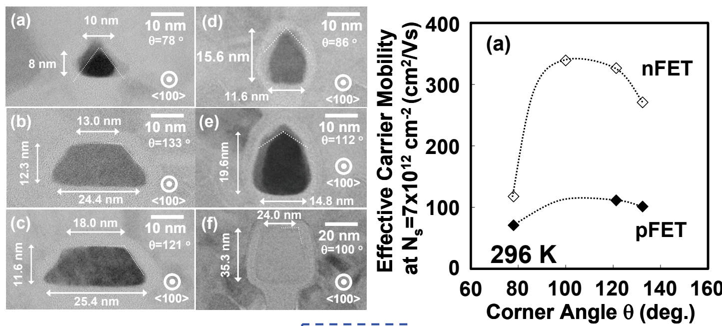


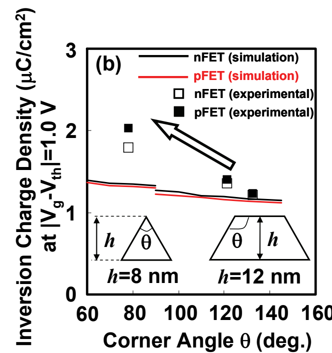
✓Normalization method



✓Successfully fabricated with conventional CMOS fabrication facilities because of semi gate-around structure.

Influences of Corner Angles



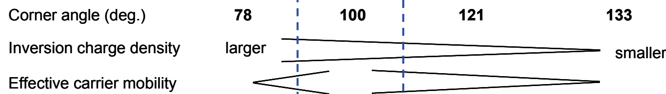


✓Effects of the upper corners are superior to those of the lower corners.

✓Effective carrier mobility of SiNW FETs with acute angle degraded severely.

✓Decrease of lower corner angle lead to mobility degradation. But not so severe due to semi gate-around structure.

nFET & pFET

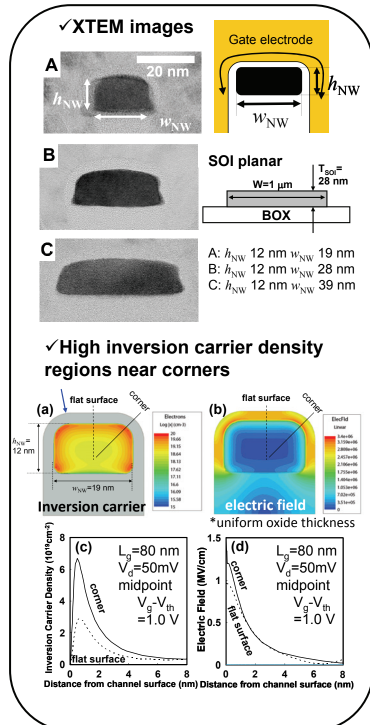


✓Optimized point of the effective carrier mobility exists near 100° of the corner angle.

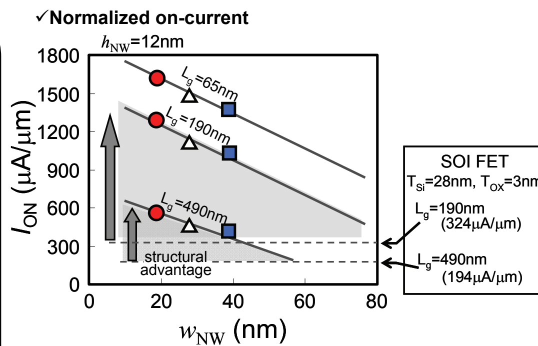
✓As the corner angle decreased, inversion charge density increased.

✓Rectangular cross-section is the most suitable for enhancement of the electrical characteristics of SiNW FETs.

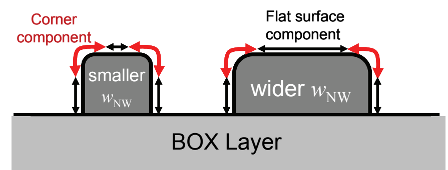
SiNW nFET with Rectangular cross-sections



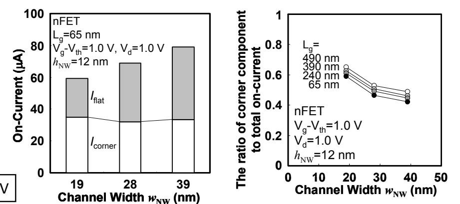
✓Normalized on-current



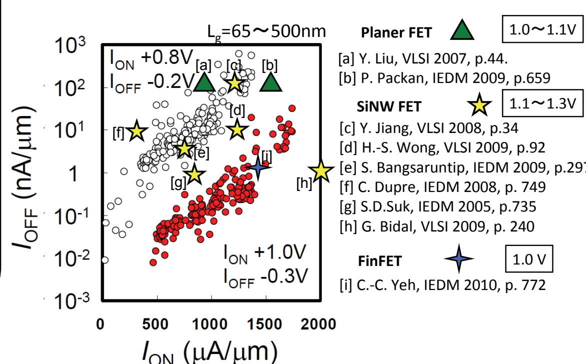
✓Separation of the on-current to the corner component and flat-surface component



✓Ther corner component occupied about 60 % to the total on-currnet



✓Benchmark



Conclusions

✓SiNW FETs with rectangular cross-section are suitable for enhancement of the on-current.
✓Corner of the rectangular cross-sections played important roles for enhancement of on-current.
✓Guidelines for design of cross-sectional shapes of the SiNW FETs are proposed.