Influences of W electrodes thickness on electrical properties of high temperature annealed La_2O_3 MOS devices for EOT of 0.5 nm

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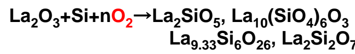
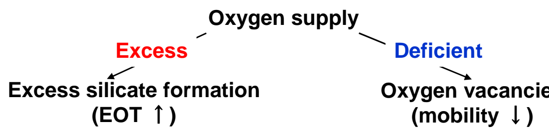
Purpose of This Work

La_2O_3 can easily achieve a direct contact of high-k/Si by forming La-silicate





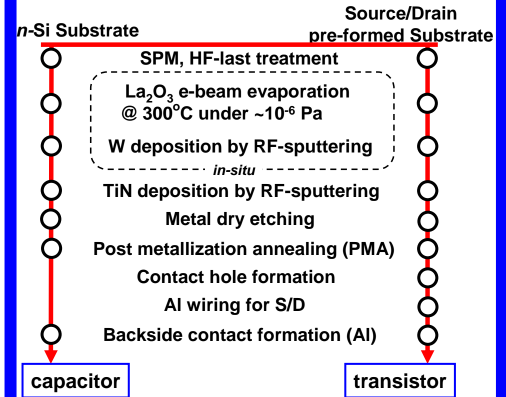
W electrode supplies oxygen to gate dielectric

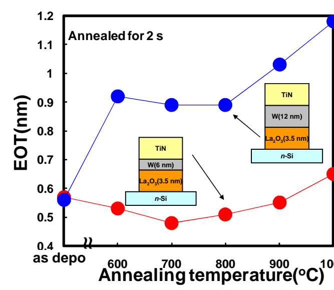
E. J. Preisler, et al., Appl. Phys. Lett., vol.85, p.6230(2004)

Purpose

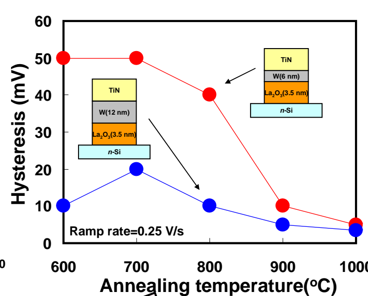
Control the oxygen supply by changing W thickness

Fabrication Process

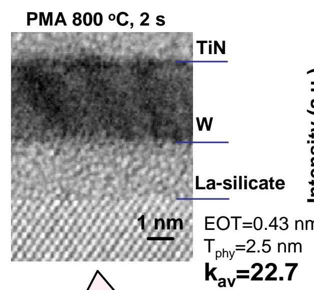




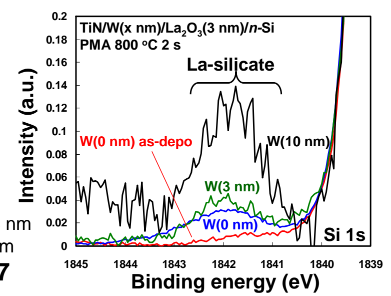
Increase of EOT can be suppressed with thinner W film



Higher temperature annealing is necessary to eliminate the hysteresis for thinner W film

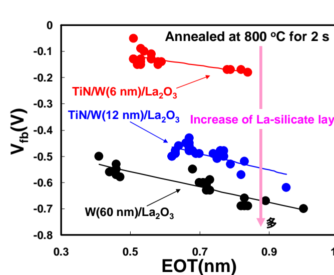


A direct contact of high-k/Si and average k-value of 22.7 are confirmed

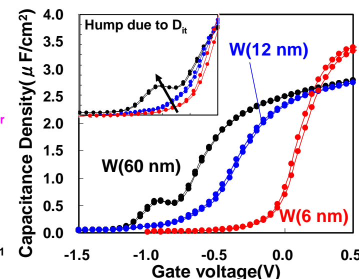


Amount of La-silicate is larger with thicker W film

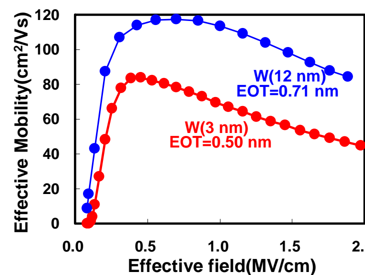
Results



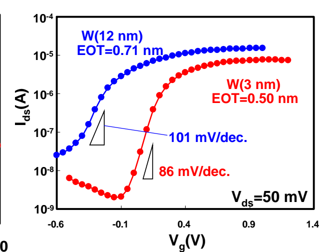
Formation of La-silicate might be contribute to positive fixed charges



Comparing the hump shapes at weak inversion region, smaller D_{it} is obtained with thinner W film



Operation of nFET with EOT of 0.5 nm is succeeded.



A Smaller S. S. is obtained with a thinner W film,.

Conclusion

- Operation of nFET with EOT of 0.5 nm is achieved by controlling the supply of oxygen through modifying the W layer thickness.
- Mobility of the devices could be further enhanced by compensating dielectric oxygen vacancies.