Study on Wet Etching of Dummy Poly-Si

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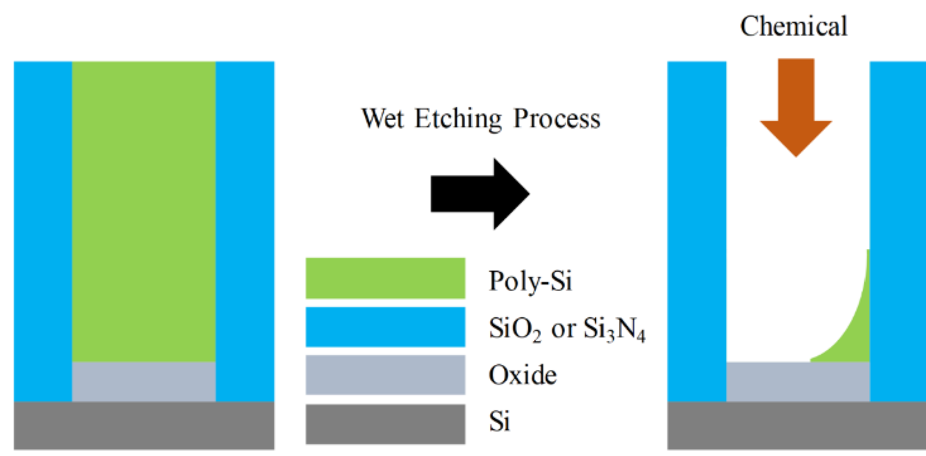
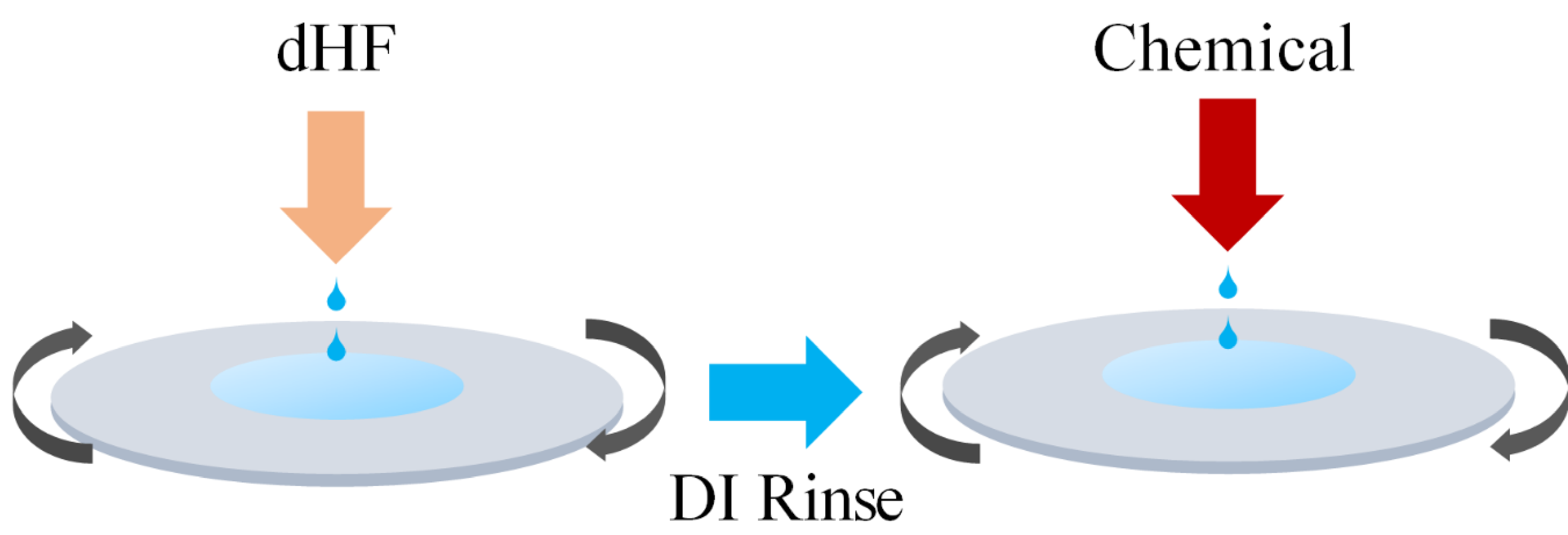
Introduction



- Before making High-K/Metal gate, polysilicon was filled at gate space for building source and drain
- The complete removal of polysilicon is necessary for transistor

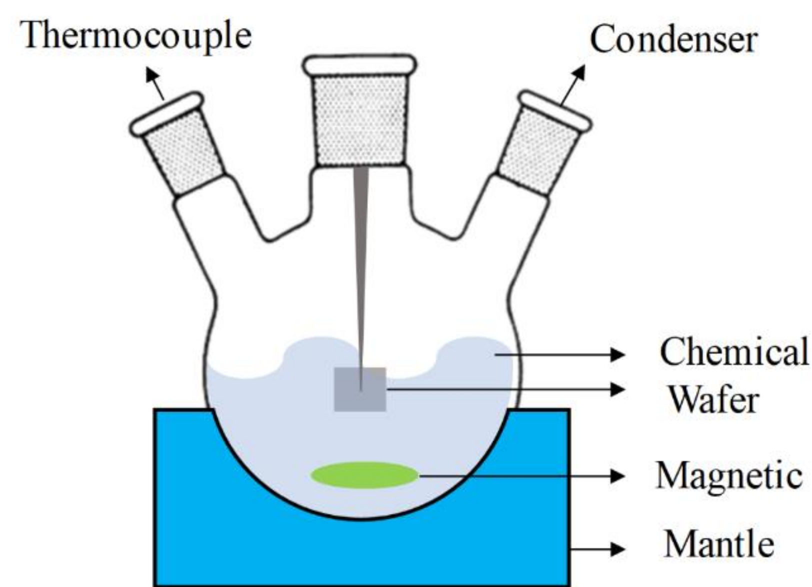
Experiment

Experiment Parameters

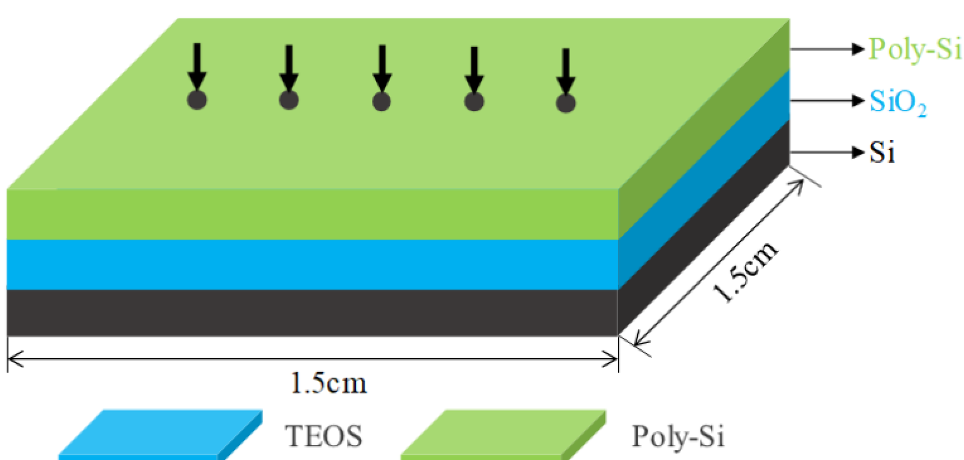


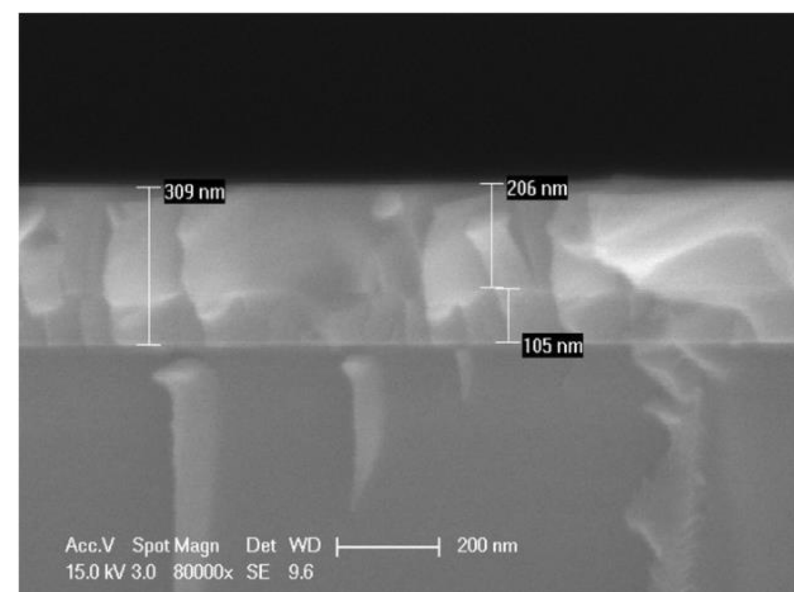
Parameter	Method
Recipe Condition	Temperature
	RPM
Chemical Condition	Chemical Concentration
	Chemical Type
Removal of Native Oxide	0.5wt% of dHF, 1 min

Experiment Process



	Parameters
Temperature	70, 80, 90 °C
Chemical Conc.	1, 6, 10 wt%
Chemical Type	Chemical-A
	Chemical-B
RPM	0, 100, 200 rpm





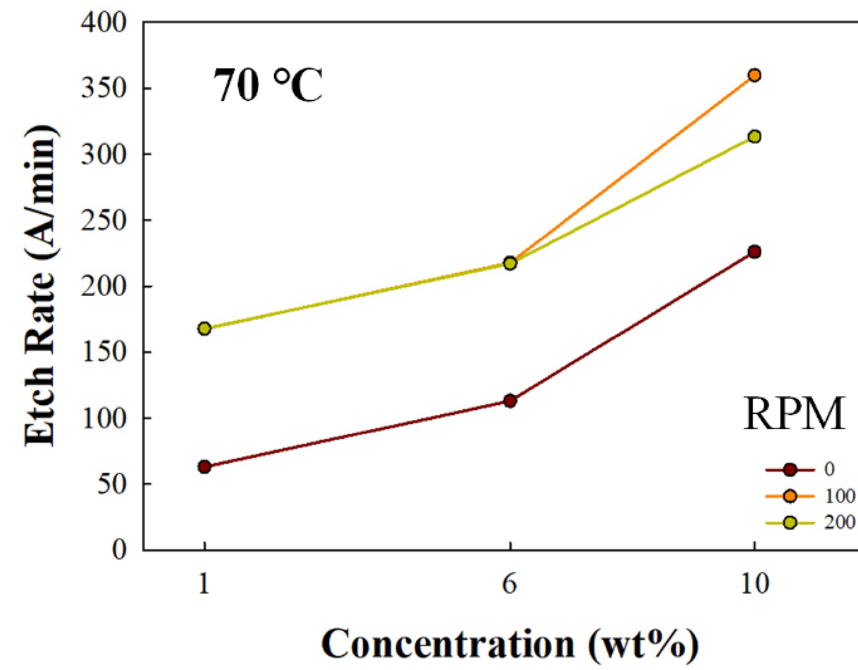
- 2000 Å of Poly-Si and 1000 Å of SiO_2 in coupon wafer
- Coupon wafer was etched by dipping in chemical using mantle and magnetic stirring in flask

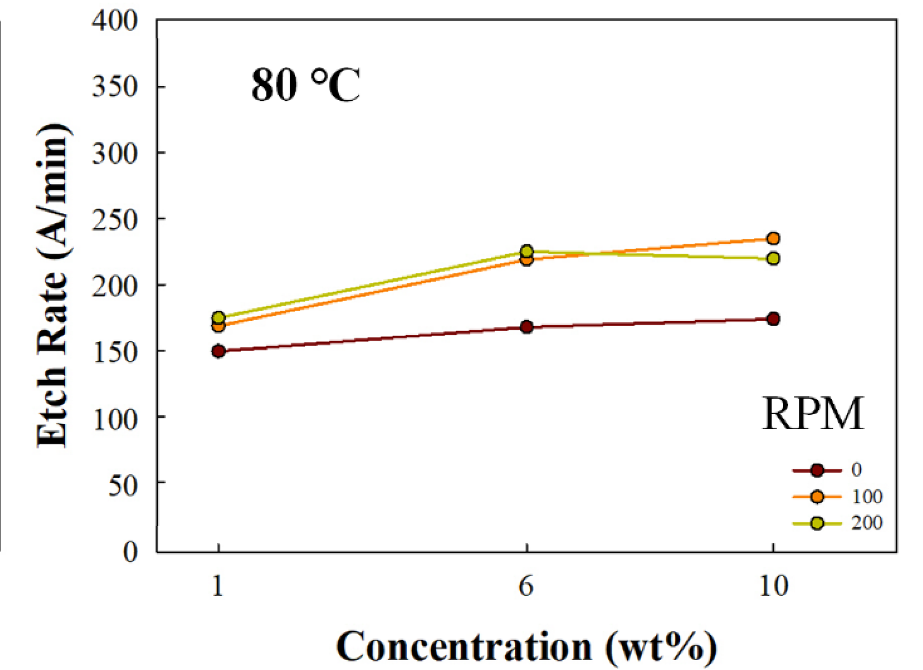
Main Goal → Suggest unremoved factors including improvement of etchant chemical

Results and Discussions

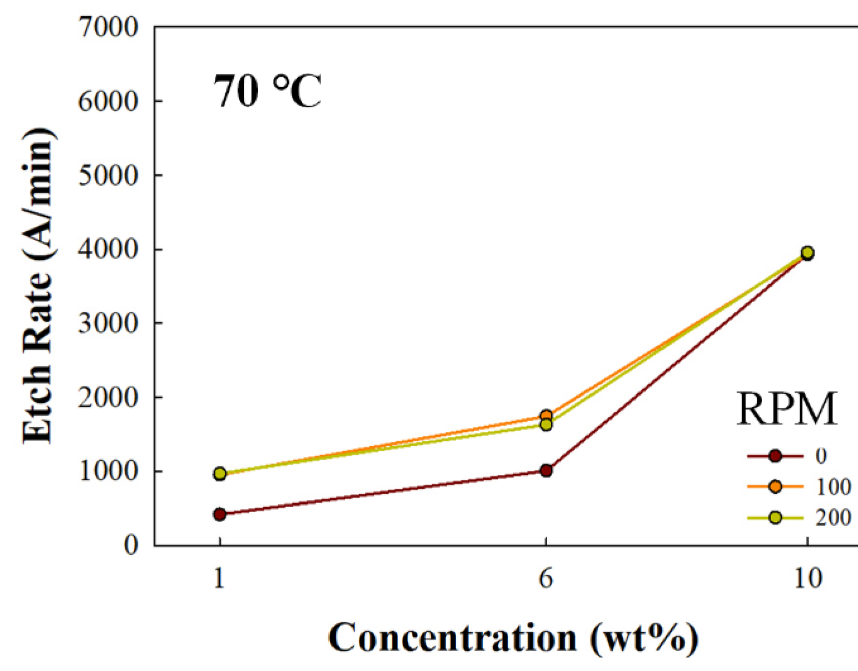
Etch Rate Results

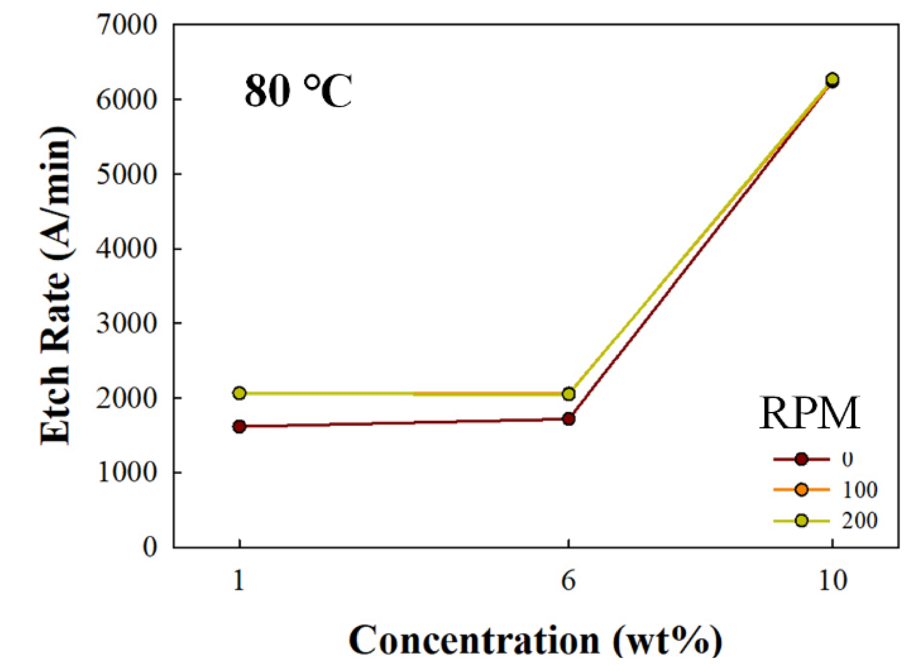
Chemical-A





Chemical-B





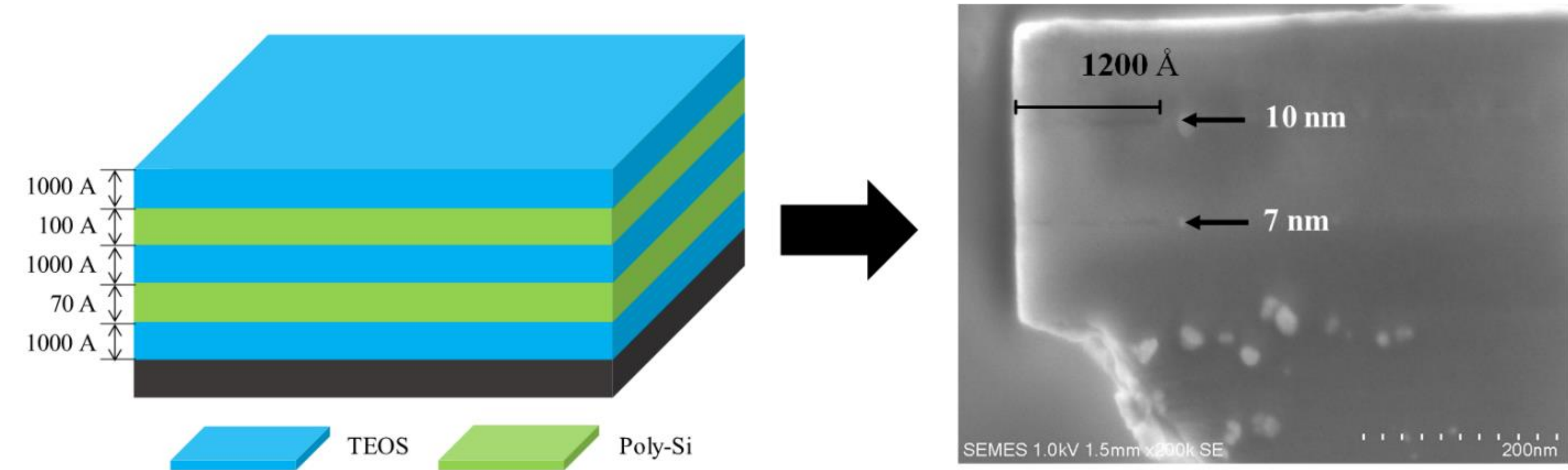
Chemical-A

Unit: Å/min	1wt%		6wt%		10wt%	
RPM \ Temp	70 °C	80 °C	70 °C	80 °C	70 °C	80 °C
0 rpm	62	150	167	169	167	175
100 rpm	167	169	217	219	359	235
200 rpm	313	226	359	235	313	220

Chemical-B

Unit: Å/min	1wt%		6wt%		10wt%	
RPM \ Temp	70 °C	80 °C	70 °C	80 °C	70 °C	80 °C
0 rpm	417	1615	1004	1717	3934	6242
100 rpm	952	2059	1744	2054	3929	6244
200 rpm	967	2059	1631	2046	3954	6270

- Etch rate of Chemical-B is much higher than Chemical-B at each conditions such as temperature, rpm and chemical concentration
- Chemical type and concentration are main factor of polysilicon etching process



- About 1200 Å of polysilicon was successfully etched at gap of 7 nm and 10 nm in SEM image using Chemical-B

Summary

- The poly-Si was etched by Chemical-A and Chemical-B
- Temperature, agitation, chemical concentration and chemical type are factors in wet etching process
- Chemical type and concentration are main factor of polysilicon etching process
- About 1200 Å of polysilicon was successfully etched at gap of 7 nm and 10 nm in SEM image at Chemical-B

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