

## Wet Oxidation using Single Wafer Furnace

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Large batch furnaces have long been used in thermal processing areas including diffusion, oxidation, implant anneal etc. As demands in operational flexibility increases and allowable thermal budget of devices decreases, single wafer thermal processing method becomes the preferred method of processing. The rapid thermal processing (RTP) is widely introduced in device manufacturing today. Two types of RTP system (lamp based single wafer processing RTP system and susceptor-based RTP system) have been developed and introduced in the market. The lamp based RTP systems have very poor energy efficiency and requires complicated temperature measurement/control algorithms. Although the susceptor based RTP systems have higher energy efficiency, they cannot be used in an oxidation environment due to the oxidation of susceptor material. To overcome the disadvantages of batch furnaces and single wafer RTP systems, a single wafer furnace (SWF) is designed.[1,2]

In this paper, wet oxidation is investigated using the SWRTF system. Oxide film thickness and uniformity were investigated as a function of temperature and process time. Silicon wafer is processed in the temperature range of 950~1150°C at 760 Torr for 60~300s. Steam is generated at a temperature-controlled canister and introduced into process chamber with carrier gas (pure N<sub>2</sub> and pure O<sub>2</sub>). The steam concentration at 30°C and 50°C of canister temperature are 4.9vol% and 13.2vol%, respectively. The wafers were placed in the preheated, nearly isothermal process chamber for predetermined process time with soaking in steam atmosphere and removed from the process chamber at process temperature. Repeatable oxide film thickness and excellent uniformity were obtained.

## References

1. W.S. Yoo, T. Yamazaki and K. Enjoji: Solid State Technology, **43** No. 7 (2000) 223.
2. W.S. Yoo, T. Fukada, H. Kuribayashi, H. Kitayama, N. Takahashi, K. Enjoji and K. Sunohara: Jpn. J. Appl. Phys. Lett., **39** (2000), L694.

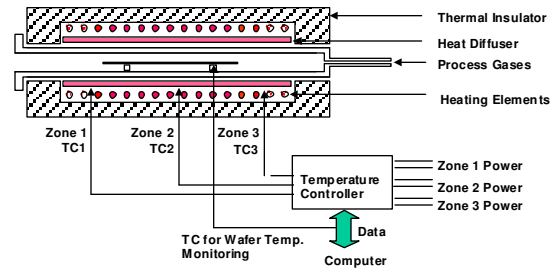


Fig. 1 Schematic diagram of SWF.

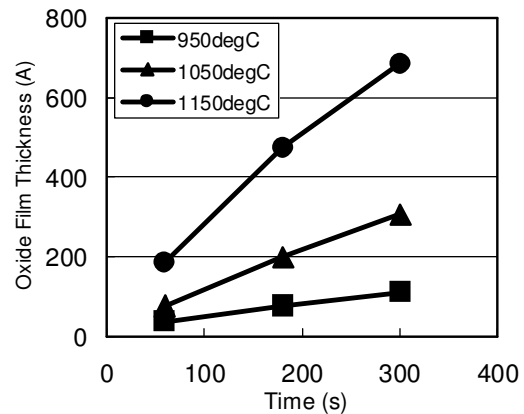
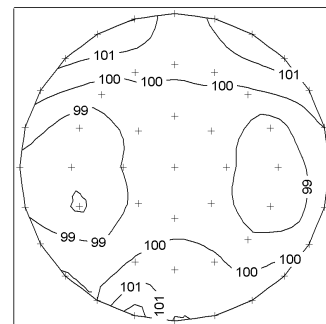


Fig. 2 Wet oxidation rate as a function of temperature and process time. (O<sub>2</sub> 1slm, H<sub>2</sub>O conc. 13.2vol%, 760 Torr)



Ave.=99.83Å, Unif.=1.04%(1σ)  
Fig. 3 Typical contour map of 100nm thick oxide film. (O<sub>2</sub> 1slm, H<sub>2</sub>O conc. 4.9vol%, 760 Torr)