

## Dry Oxidation and Implant Anneal in a Single Wafer Rapid Thermal 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.

In this paper, the design concept and thermal behavior of a dual chamber, single wafer furnace (SWF) with a vacuum loadlock are described. The SWF system is vacuum and atmospheric pressure compatible. The process chamber has no moving parts and can be used in 100% oxygen environment. Thermal characteristics and process performance of the system are investigated in detail in the temperature range of 200-1150°C. The wafer temperature profile, ramp rate, and within-wafer temperature uniformity during ramp were extensively characterized as a function of heat source temperature, pressure, and processing time. From a production point of view, temperature repeatability, process repeatability, throughput, electric power consumption, and facility requirement were also summarized.

Excellent process performance of the SWF system has been demonstrated in TiSi, dry oxidation and implant annealing applications in

the temperature range of 200~1150°C. A very high ramp rate (~150°C/s) was obtained in the high temperature region (~1150°C) while the electric power consumption was kept minimal (<3.5kW per process chamber at 1150°C). Typical throughput for 60s process in a dual chamber system is ~60 wph. Details of titanium silicide, dry oxidation and implant annealing process results will be presented at the conference.

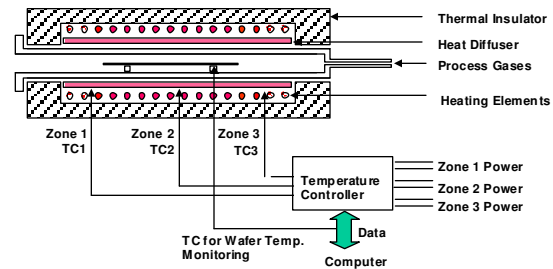


Fig. 1. Schematic illustration of single wafer furnace process chamber.

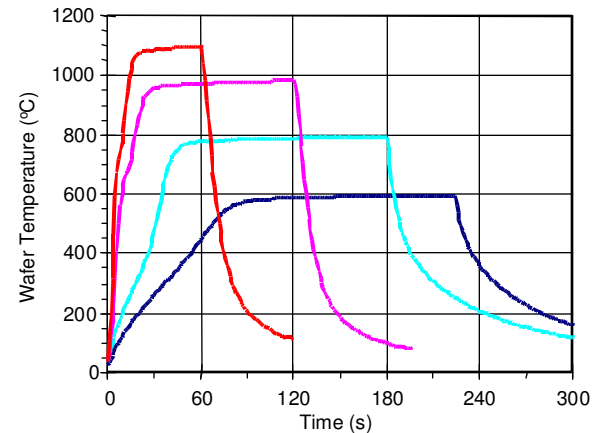


Fig. 2. Typical wafer temperature profile during process.