101年大學部國際交流甄選專題成果展

The Simulate Optimization Of The Metal-Organic Chemical Vapor Deposition Heater

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Abstract

Now, the device of illumination is the major developing devices in Taiwan. We have good techniques but lack the abilities for producing the key equipment which makes we be restricted by the foreign incorporation.

In our research, we focus on the chemical process of metal-organic chemical vapor deposition and than design a heater to heat 8 inch wafers. First, the material of susceptor we used is graphite. Second, we coat a SiC thin film on the susceptor surface. Finally, we design the geometry of resistance by ourselves and than compare with the patent. By our simulation, we can know the time reaching the temperature of chemical reaction.

Methods

Figure 2.1 MOCVD heater

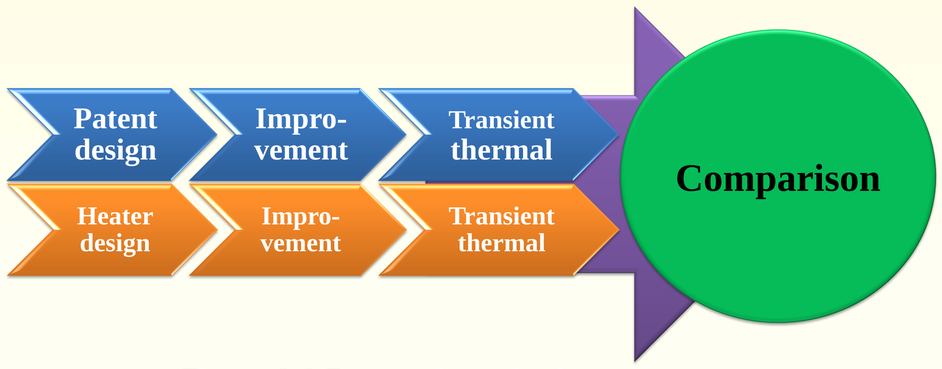


Figure 2.2 Research methods

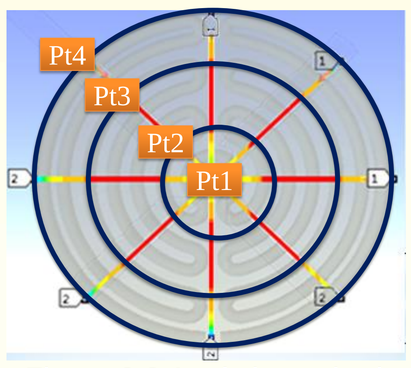


Figure 2.3 Analytic methods

Pt1 : Center temperature.

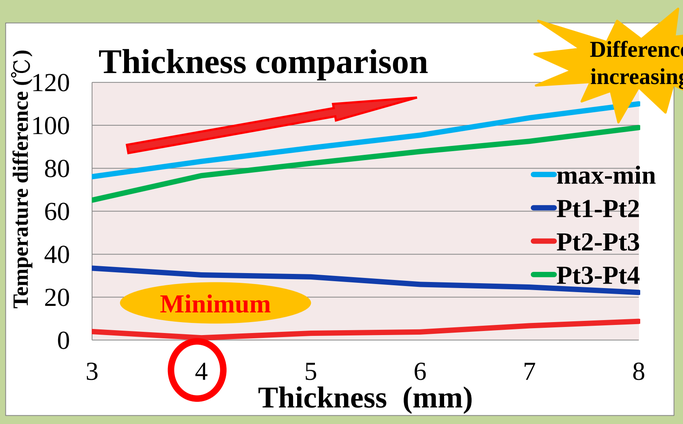
Pt2 : The average temperature of radius 42.5 mm.

Pt3 : The average temperature of radius 85 mm.

Pt4 : Edged temperature.

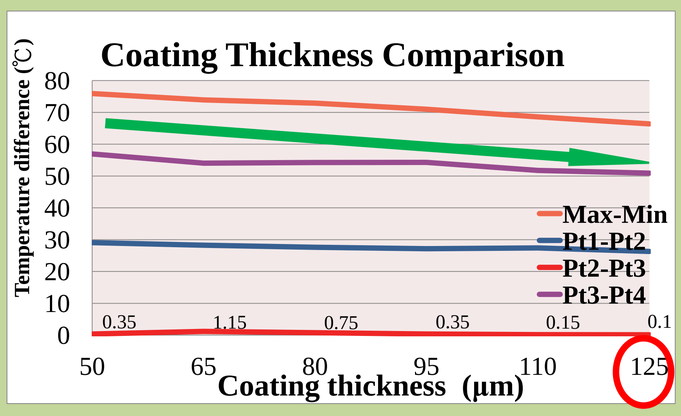
Results

Thickness



Increasing the graphite thickness would make the difference between maximum and minimum increase. The thickness of 4mm is better than the others.

Figure 3.1 Comparison of graphite thickness

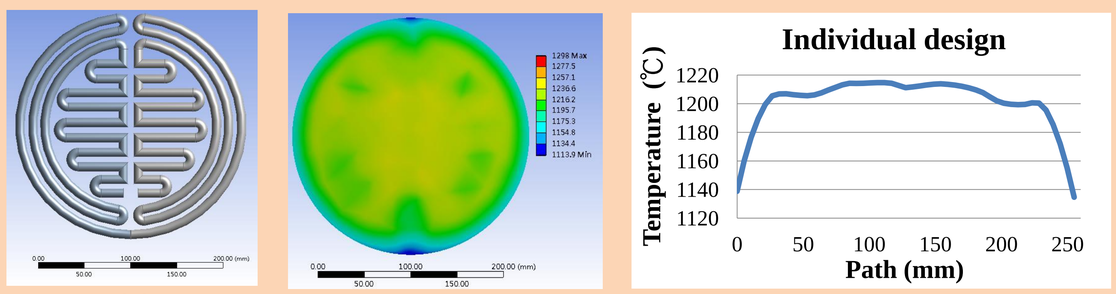


The typical SiC coating is 50μm to 125μm.

The thicker SiC coating would decrease the difference of temperature.

Figure 3.2 Comparison of coating thickness

Individual design



(a) (b) (c)

Figure 3.4 (a)self-design (b) Surface temperature (c) Temperature curve

Heating time

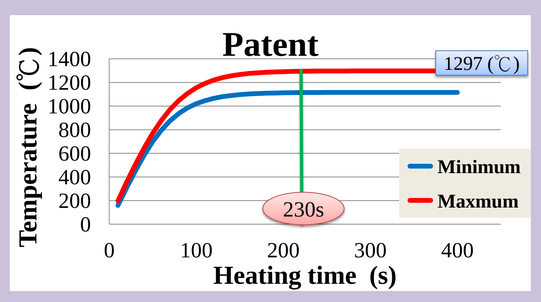


Figure 3.5 Heating of patent

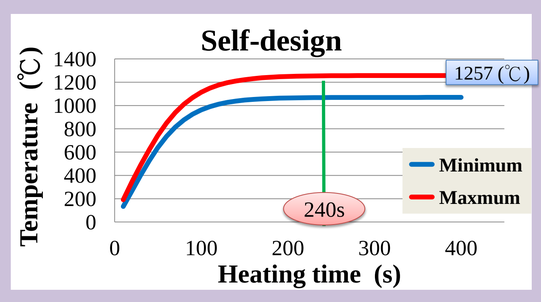
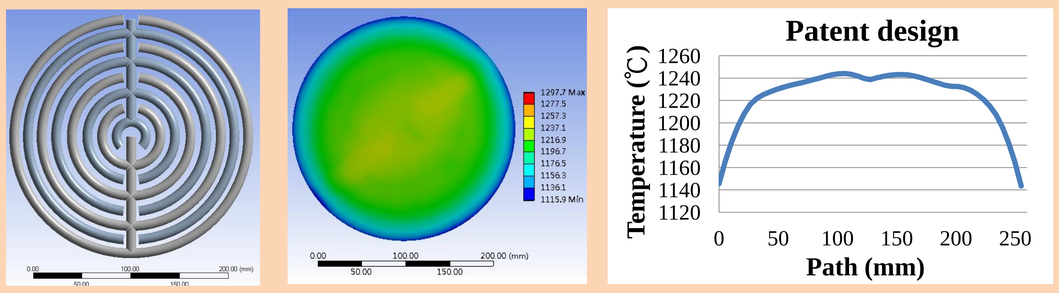


Figure 3.6 Heating of self-design

MOCVD heater needs to reach steady-state quickly. When the power supply generate a uniform power. Patent design needs to be heat until 230th second. Our design needs 240 second to reach steady-state.

Patent design



(a) (b) (c)

Figure 3.3 (a) Patent (b) Surface temperature (c) Temperature curve

Comparison

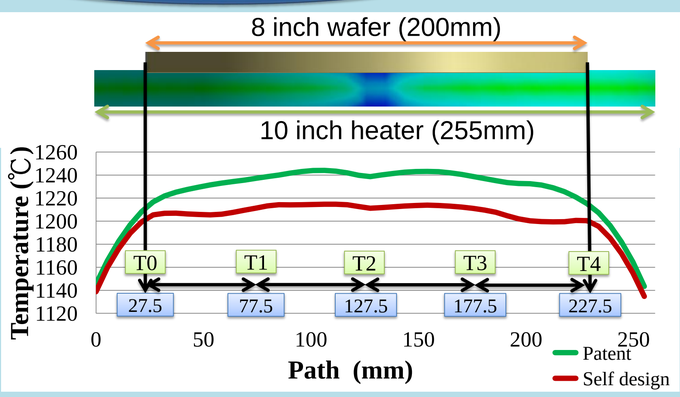


Figure 3.7 Comparison of patent and self-design

Table 3.1 Comparison

	T1-T0	T2-T1	T2-T3	T3-T4
patent	21.2(℃)	-0.75(℃)	0.84(℃)	22.8(℃)
Self-design	6.77(℃)	-1.17(℃)	0.81(℃)	9.95(℃)

Our design has the smaller difference between each point than the patent.

Conclusions

The parameter of optimization are:

(1) The thickness of susceptor is 4mm.
(2) The thickness of coating film is 125μm.
(3) The time reaches to steady-state need 240s.
(4) For heating a 8 inch wafer, self design had better result.

Acknowledgement

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