101年大學部國際交流甄選專題成果展

Parameters Study in ICP-CVD for Deposition Rate of Amorphous Silicon Thin Films

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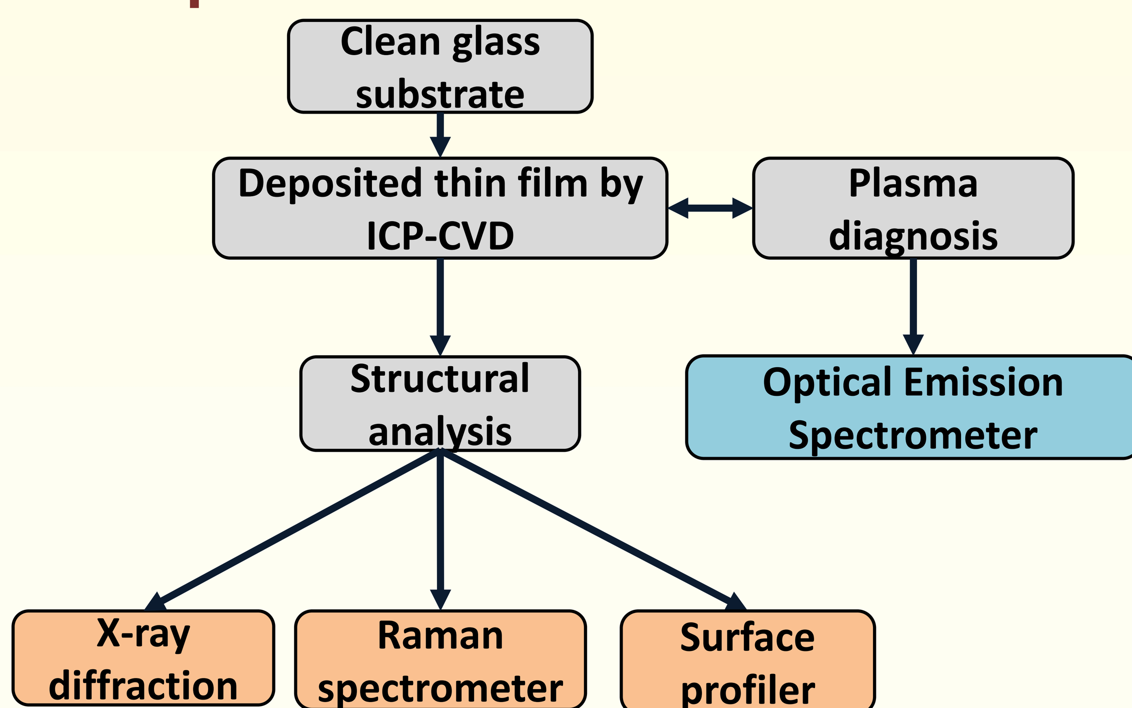
Abstract

- Amorphous silicon thin films were deposited on glass substrates in an ICP-CVD (inductively coupling plasma) system.
- Testing different process parameters to obtain the maximum deposition rate.
- OES (optical emission spectrometer) were utilize to detect plasma species during deposition.
- Structures of amorphous hydrogenated silicon thin film were examined by XRD and Raman spectrometer.

Experimental Procedure



Process Parameters	
Antenna power(RF, W)	2500
Working pressure(mtorr)	20
Substrate temperature(℃)	200
SiH_4 flow rate(sccm)	50
H_2 flow rate(sccm)	**0/50/100**
Ar flow rate(sccm)	**5/10/15**
Deposition Time (min)	5

Deposition rate

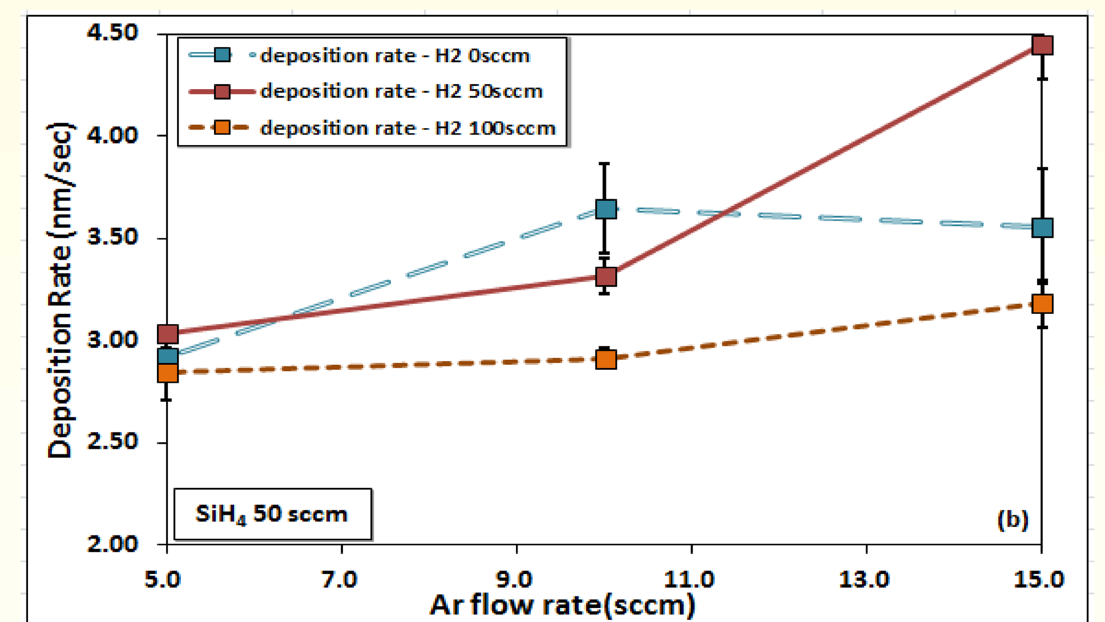


Figure 1 Deposition rate of thin films

Optical emission spectroscopy

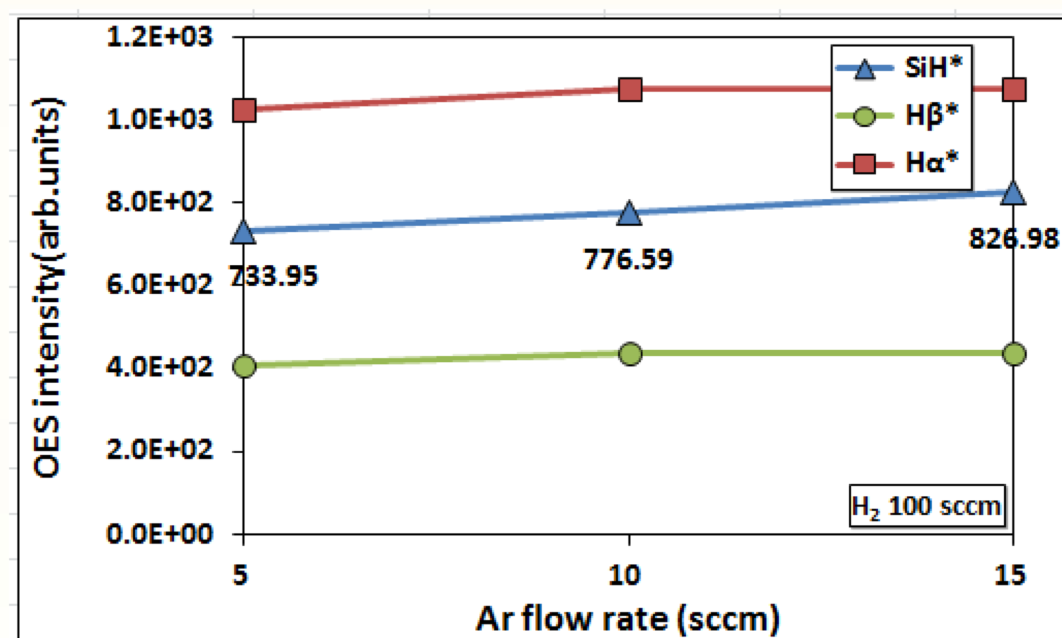


Figure 2 OES intensities of SiH*, H_α*, H_β* with H_2 flow rate 100sccm.

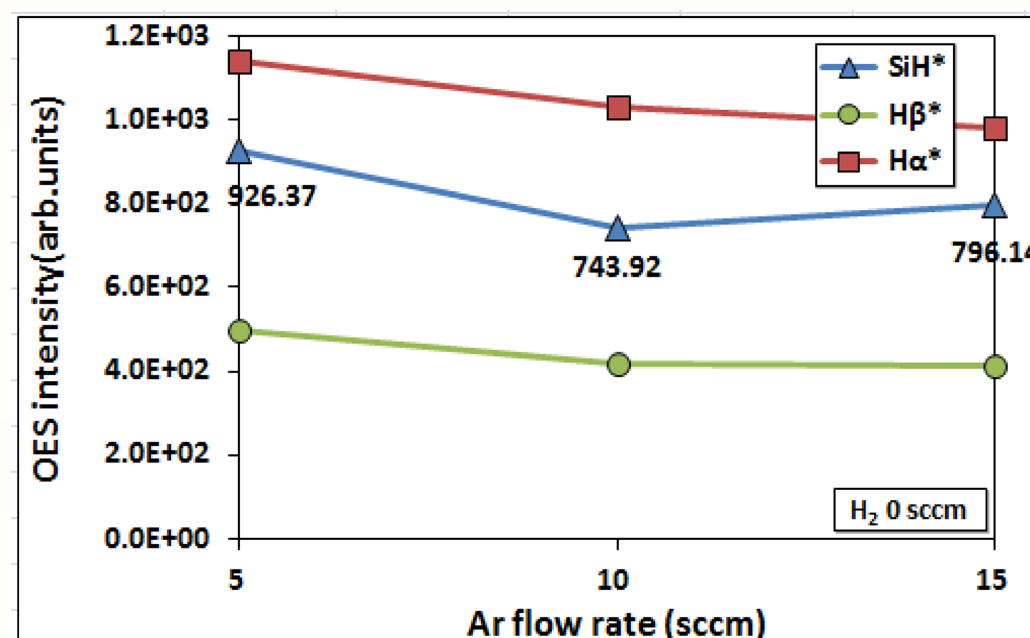


Figure 4 OES intensities of SiH*, H_α*, H_β* with H_2 flow rate 0sccm.

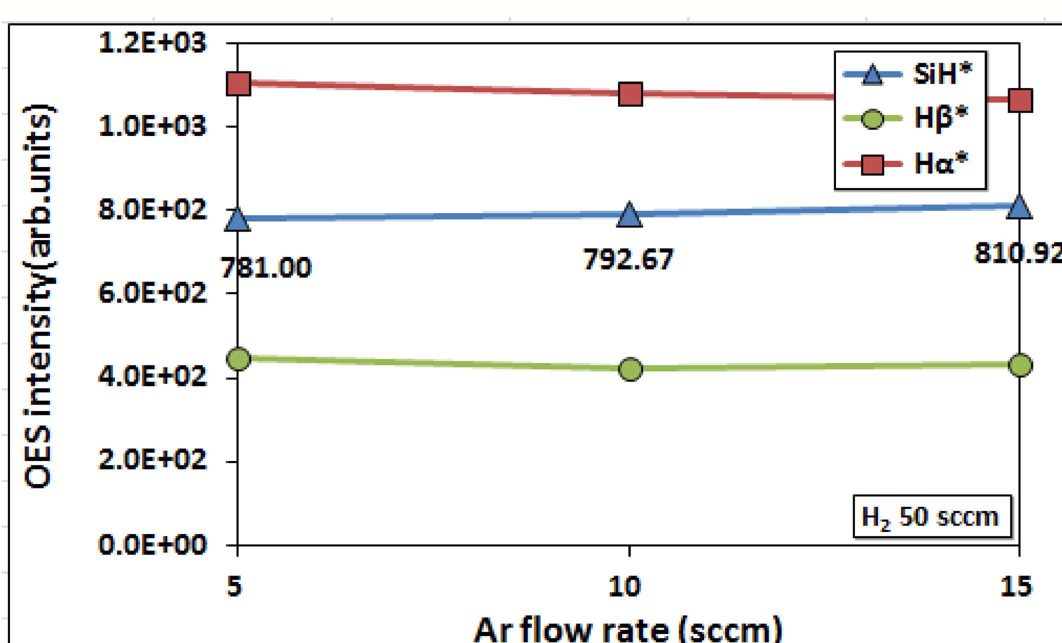


Figure 3 OES intensities of SiH*, H_α*, H_β* with H_2 flow rate 50sccm.

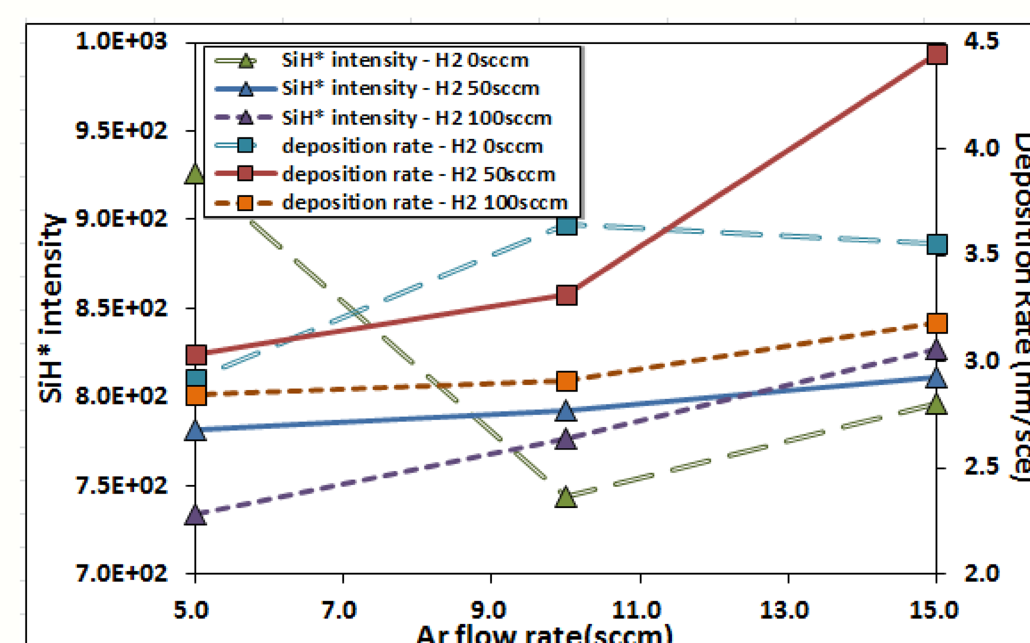


Figure 5 OES intensities of SiH* and deposition rate

X-ray diffraction

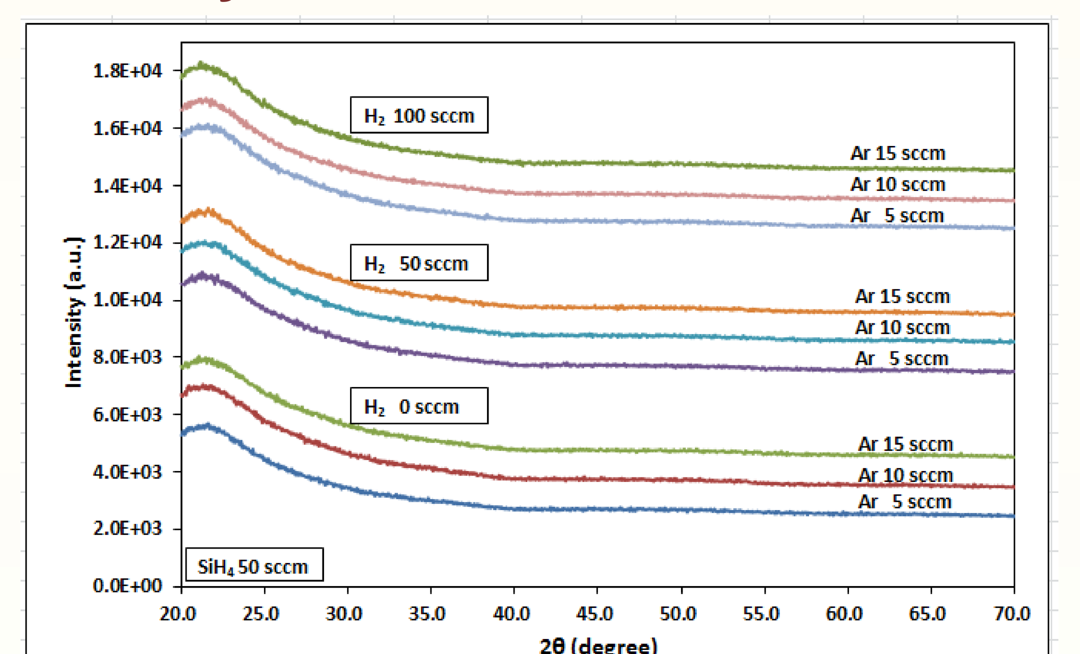


Figure 6 XRD of amorphous thin films

Raman spectroscopy

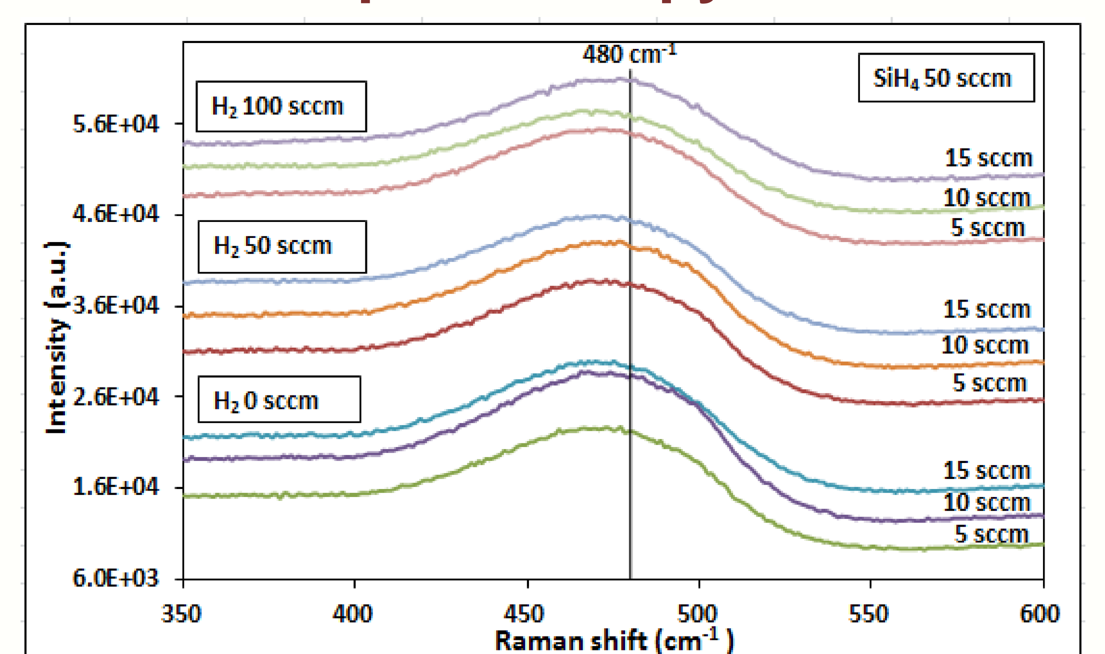


Figure 7 Raman spectrometer of amorphous thin films

Conclusion

- H_2 50sccm led to a higher deposition rates of amorphous Si films by ICP-CVD.
- The maximum deposition rate by ICP-CVD reached 4.57nm/s under H_2 50sccm and Ar 15sccm and SiH_4 50sccm .
- All deposited films were amorphous confirmed by XRD and Raman spectroscopy.
- OES data shows that deposition rate was increased by the presence of SiH^* in plasma with appropriate supply of H_2 flow rate.