

## Chapter five

### Conclusion

The main objective of this project is to study the effects of weak acid hydrolysis on the sol gel fabrication of silica thin film. It has been extensively investigated for the fabrication of optical wave-guides because sol-gel and spin coating technique is a convenient and flexible way to deposit oxide films on a variety of substrates. In this particular project, acetic acid, propionic acid, malonic acid, and maleic acid doped tetraethoxysilane (TEOS) coatings were deposited on glass substrates using the sol-gel and spin-coating techniques.

For acetic acid doped sol-gel coating homogeneous and crack free monolayer thin films and a good coverage of surface were achieved after application of a solution concentration of  $12 \text{ mol dm}^{-3}$ ,  $10 \text{ mol dm}^{-3}$  respectively. AFM and SEM examination evidenced that the formation of 155 to 283 nm thick film composed of 1-5  $\mu\text{m}$  spheroid grains. In the case of propionic acid doped sol-gel coating, homogeneous crack free monolayer thin films were achieved 2.00 ml and 1.50 ml respectively. AFM and SEM investigation revealed that the formation of 155 nm to 283 nm thick thin films composed of 1-5  $\mu\text{m}$  spheroid grains.

On the otherhand, in the case of malonic and maleic acid composed sol-gel coating, the films were neither homogenous nor crack free. The photomicrographs of SEM are clearly shown the crack and non-homogeneity of the silica thin film.

In conclusion from the results obtained through SEM and AFM, one can anticipate among these four weak acids, the quality of thin film development for the application in planer wave-guide is more likely possible via acetic acid doped sol-gel route than other acids.

This current research work being a partial fulfillment could not jump into the final conclusion as the thickness of typical wave-guide should be 3  $\mu\text{m}$  14  $\mu\text{m}$  and should apply at least 12 coating and sintering process for a 250 nm thickness of silica thin film obtained through this fabrication process. In addition to the effect of temperature, the environment and the concentration of alkoxide used on sol-gel should also be considered.