

CHAPTER 5 CONCLUSION

The approximate value of a RLC single loop circuit can be estimated from the laser power output. This power output was close to the power that measured by oscilloscope. The circuit of flashlamp in Nd:YAG laser may be used a multi-loop RLC circuits. The values of power output from RLC single loop may be different with real power output.

In some simulation results from the surface temperature of aluminum is lower than the melting point of aluminum, for example at 1 J in different voltages 300, 400 and 500 V but in experimental results, the aluminum can melted in these cases. Because the model of the surface temperature used only the heat conduction equation that excluded the pressure equation of pulsed laser. In future, the pressure equation should be added to this model to provide more accuracy of surface temperature.

Laser ablation in liquid is a one – step, direct and very simple preparation procedure for synthesizing nanomaterials. In this study, alumina or Al_2O_3 nanoparticles were successfully synthesized by laser ablation in deionized water. Nd:YAG laser (wavelength 1064 nm) was used in the experimental.

The average size of alumina nanoparticle using voltage 300 V with laser energy 1 J at repetition rate 2 Hz has smaller than voltage 400 and 500 V. Average sizes of alumina nanoparticles were increased in laser energies 3 and 5 J due to temperature and pressure in the plasma plume were increased. However, all alumina nanoparticles were melted by high temperature and high pressure when the laser energy was increased to 7 J. The average size of alumina nanoparticle using voltage 400 V and 500 V were similar resulted as the voltage 300 V.

The same ablation time (40 min) using different repetition rates. The average size of alumina nanoparticles were decreased when the repetition rate were increased. Due to the high repetition rate affected to quantity of alumina nanoparticles. The suspended particles in the deionized water were smaller because It absorbed the laser energy before laser was irradiated to target.

Structure of alumina nanoparticle from laser ablation using 300 V with 1, 3 and 5 J were $\gamma\text{-Al}_2\text{O}_3$ (same JCPDS number) with face center cubic crystal structure due to the cooling rate of plasma plume in range of $\gamma\text{-Al}_2\text{O}_3$ formation but the intensities were different.

Alumina nanoparticles have absorbance peak at 210 nm and the intensity of alumina nanoparticles depend on energy. The concentrations of nanoparticles suspended on deionized water were increased with increasing laser energy. The concentrations of nanoparticles in different energies (1, 3 and 5 J) at 300 V were calculated using absorption spectra of UV-Vis results.

The chemical compositions were investigated in both EDS and XPS survey scan. The survey scan of XPS results shown the bonding energy of nanoparticles were Al_2O_3 . The binding energy of aluminum and water were found in analysis of major peak (Al2p and O1s) but It cannot exactly point out the phase of alumina nanoparticles.