

CONCLUSION

The nickel aluminate precursors; SPNO, SPCI, SPOH and SPAC were successfully prepared from inexpensive and relatively abundant starting materials via one pot process and can be converted to nickel aluminate spinel powder by pyrolyzing. It was found that the precursors pyrolyzed at 800°C for 5 h in air produced a NiO-NiAl₂O₄ solid solution. However, pure nickel aluminate spinel was obtained when SPNO and SPAC were calcined at 1000°C for 5 h. After calcinations of SPCI and SPOH at 900°C or even at 1000°C, XRD patterns showed two crystalline phases of NiO and NiAl₂O₄. The results from SEM and BET indicate that the obtained NiAl₂O₄ powder showed a porous microstructure with irregular shaped of block-like particles and has not high surface area.

Nickel aluminate spinel was also prepared via sol-gel route by using SPNO and SPAC precursors as starting metal alkoxide. The reaction variables, solvent, concentration of the precursor, pH and gelation temperature, affected dramatically the gelation time. Heat treatment of the all resulting SPNO and SPAC gels at 1000 °C for 5 h exhibited two phases of NiAl₂O₄ and NiO. It was found that sol-gel processing strongly influences the microstructure and morphology of the calcined product. The most uniform microstructure of powder resulted from the SPNO gel occurred at room temperature in ethanolic solution with the system of 28.0 %(w/v), pH 10.0 was made up of spherical particles with grain sizes ranging from 100 – 150 nm. The powder resulted from SPAC gel occurred in i-propanolic solution, pH 8.0 with the system of 16.0 %(w/v) consists of nearly spherical particle size and shape with grain sizes ranging from 200 – 300 nm. By comparing the values of the BET surface area, pore volume and pore size of the powders obtained via sol-gel with those direct calcination of one pot products, a slight different was found.

Due to the nickel aluminate spinel powders which obtained via sol-gel route have low purity and surface area value. In the future work, the other sol-gel process parameters, such as aging time and addition of surfactant into the precursor solution were suggested in order to study the possibility to prepare high surface nickel aluminate spinel.