

# SYNTHESIS OF $\text{LiM}_x\text{Mn}_{2-x}\text{O}_4$ (M: Co, Ni, Cr) WITH SIMPLE SOLID-STATE METHOD BASED ON MICROWAVE IRRADIATION AND ITS APPLICATION AS LITHIUM ION BATTERY CATHODES

by Dyah Purwaningsih

## ABSTRACT

This study aims to find out the relationship between the quantity and types of  $\text{LiM}_x\text{Mn}_{2-x}\text{O}_4$  (M: Co, Ni and Cr) and the physical characteristics (particle size, morphology and microstructure) of  $\text{LiM}_x\text{Mn}_{2-x}\text{O}_4$ .

It serves as a development of the previous research that synthesized  $\text{LiMn}_2\text{O}_4$  using simple solid-state method assisted by microwave irradiation. The variable examined in this study was the effects of dopant quantity and types on  $\text{LiMn}_2\text{O}_4$ . Quantity and type of dopant greatly affect the character of the results of the synthesis which includes purity, phase type, structure stability and crystallinity so that certain technique and control of these factors are needed. The synthesized  $\text{LiM}_x\text{Mn}_{2-x}\text{O}_4$  was characterized using XRD and SEM-EDX while the microstructure characterization was carried out *ab initio* using the WinPlotR and Diamond programs.

$\text{LiM}_x\text{Mn}_{2-x}\text{O}_4$  compounds (M: Co, Ni, and Cr) with  $x = 0; 0.02; 0.04; 0.06; 0.08; 0.10$  can be synthesized using microwave irradiation-assisted reflux techniques. The results of XRD data analysis show that the compounds  $\text{LiNi}_x\text{Mn}_{2-x}\text{O}_4$  and  $\text{LiCr}_x\text{Mn}_{2-x}\text{O}_4$  had a cubic crystal system with a  $Fd-3m$  space group. As the variation of the value of  $x$  added increases, the lattice parameter value of  $\text{LiNi}_x\text{Mn}_{2-x}\text{O}_4$  decreases, while that of  $\text{LiCr}_x\text{Mn}_{2-x}\text{O}_4$  increases. The results of SEM-EDX data analysis show that the surface of  $\text{LiMn}_2\text{O}_4$  and  $\text{LiM}_x\text{Mn}_{2-x}\text{O}_4$  (M: Co, Ni and Cr) compounds is irregularly shaped with a rough surface and there are cavities on its surface.

Kata Kunci:  $\text{LiM}_x\text{Mn}_{2-x}\text{O}_4$  (M: Co, Ni, Cr), solid-state, microwave, structural characterization