

PREPARATION AND IONIC CONDUCTIVITY OF $\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$ USING WASTE CHICKEN EGGSHELLS AS Ca SOURCE FOR ANODE MATERIAL OF LITHIUM ION BATTERIES

Achmad Subhan^a, Dedy Setiawan^b, Slamet Priyono^a

^a*Indonesian Institute of Sciences-Research Center for Physics (LIPI), Serpong, Indonesia*
^b*Physics Department UIN Syarif Hidayatullah Jakarta, Ciputat, Indonesia*

E-mail : achm037@lipi.go.id

ABSTRACT

$\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$ has been synthesized as anode material for lithium-ion batteries parallel with $\text{Li}_4\text{Ti}_5\text{O}_{12}$ anode material using solid state reaction method in an air atmosphere. $\text{LiOH}\cdot\text{H}_2\text{O}$, TiO_2 , and waste chicken eggshells in the form of CaCO_3 were chosen as sources of Li, Ti, and Ca respectively and prepared using stoichiometric. The phase structure, morphology, and electrochemical impedance of as-prepared samples were characterized using XRD, SEM, and EIS. The XRD characterization revealed that in $\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$ sample, all amount of dopant had entered the lattice structure of $\text{Li}_4\text{Ti}_5\text{O}_{12}$. The EDX image also detect the existence of Ca in the structure of $\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$. The EIS characterization revealed that the $\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$ sample had lower electrochemical impedance compared to the $\text{Li}_4\text{Ti}_5\text{O}_{12}$ sample. The diffusion coefficient were obtained by Faraday's method, and exhibited that the $\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$ sample ($1.46986 \times 10^{-12} \text{ cm}^2/\text{s}$) had higher ionic conductivity than the $\text{Li}_4\text{Ti}_5\text{O}_{12}$ sample ($4.40995 \times 10^{-16} \text{ cm}^2/\text{s}$). According to the cycle performance test, the $\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$ sample also had higher charge-discharge capacity and stability compared to the $\text{Li}_4\text{Ti}_5\text{O}_{12}$ sample.

Keywords: $\text{Li}_{3.9}\text{Ca}_{0.1}\text{Ti}_5\text{O}_{12}$; Anode Material; Lithium-ion Batteries; Waste Chicken Eggshell; Ionic Conductivity;
