

ABSTRAK

PENGARUH VARIASI KOMPOSISI GRAFIT DAN *POLYANION* Na₂FeSiO₄ BERBASIS SILIKA SEKAM PADI PADA SUHU *SINTERING* 800 °C TERHADAP FASA KRISTAL DAN SIFAT LISTRIK DALAM PEMBENTUKAN KATODE *SODIUM ION BATTERIES* (SIBs)

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Pembuatan katode *Sodium ion Batteries* (SIBs) dari bahan grafit dan Na₂FeSiO₄ berbasis silika sekam padi telah dilakukan. Silika pada penelitian ini diekstrak menggunakan metode sol-gel. Bahan tersebut dicampur dengan NaOH, Fe(NO₃)₃.9H₂O yang diikat oleh C₆H₈O₇.H₂O yang dilarutkan dengan H₂O untuk membentuk senyawa Na₂FeSiO₄ dengan menggunakan metode sol-gel. Senyawa Na₂FeSiO₄ yang dihasilkan disintering menggunakan suhu 800 °C dengan waktu tahan 10 jam. Kemudian, senyawa Na₂FeSiO₄ dan grafit divariasikan komposisi yang diikat oleh polimer berupa CMC yang dilarutkan dengan *N-Methylpyrrolidine* dan dikeringkan T=120 °C selama = 1 jam. Lalu, sampel dianalisis menggunakan FTIR, XRD, UV-Vis DRS, dan LCR Meter. Senyawa Na₂FeSiO₄ pada sampel dicirikan dengan keberadaan gugus Na-O, Fe-O, Si-O, dan seiring penambahan grafit pada sampel terdapat pergeseran gugus C=C di area bilangan gelombang 1580-1595 cm⁻¹. Kemudian, hasil analisis fasa menunjukkan adanya 4 fasa kristal yang terbentuk yaitu Na₂FeSiO₄, Na₂SiO₃, SiO₂ dan grafit. Seiring penambahan grafit pada sampel terdapat kenaikan nilai intensitas fasa grafit di 2θ=26,56° pada difraktogram. Banyaknya komposisi grafit pada sampel berhasil menurunkan nilai energi *band gap* dengan nilai hasil pengujian berturut-turut 2,25; 1,84; 1,70; dan 1,69 eV. Lalu, berdasarkan hasil pengujian nilai konduktivitas listrik pada sampel katode termasuk ke dalam bahan semikonduktor dengan nilai pengujian mencapai 10⁻² S/m.

Kata Kunci : Energi *band gap*, gugus fungsi, konduktivitas listrik, Na₂FeSiO₄, silika sekam padi, struktur kristal, grafit, CMC.

ABSTRACT

EFFECT OF VARIATIONS IN THE COMPOSITION OF GRAPHITE AND POLYANION $\text{Na}_2\text{FeSiO}_4$ SILICA-BASED RICE HUSKS AT A SINTERING TEMPERATURE OF 800°C ON THE CRYSTAL PHASE AND ELECTRICAL PROPERTIES IN THE FORMATION OF CATHODES OF SODIUM ION BATTERIES (SIBs)

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The Synthesis of Sodium-ion Batteries (SIBs) cathodes from graphite and $\text{Na}_2\text{FeSiO}_4$ materials based on rice husks was successfully carried out. Silica in this study was obtained from rice husks extracted using the sol-gel method. Then, the extracted silica was mixed with NaOH, $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ bound by $\text{C}_6\text{H}_8\text{O}_7 \cdot \text{H}_2\text{O}$ to form The $\text{Na}_2\text{FeSiO}_4$ compound by using sol-gel method. Then, the $\text{Na}_2\text{FeSiO}_4$ compound was sintered at a temperature of 800°C with a lasting time of 10 hours. After that, $\text{Na}_2\text{FeSiO}_4$ and graphite compounds were varied in composition that bound by a polymer in the form of CMC. The dissolved with N-Methylpyrrolidine and dried at $T=120^\circ\text{C}$ for = 1 hour. The resulting cathode sample was analyzed using FTIR, XRD, UV-Vis DRS, and LCR Meter. The Compound $\text{Na}_2\text{FeSiO}_4$ in the sample was characterized by the presence of the Na-O, Fe-O, and Si-O groups, and in line with the addition of graphite to the sample there was a shift of the C = C group in the area of the wave number $1580\text{-}1595\text{ cm}^{-1}$. Then, the results of phase analysis show that there were 4 phase crystals formed, namely $\text{Na}_2\text{FeSiO}_4$, Na_2SiO_3 , SiO_2 and graphite. In line with the addition of graphite to the sample, there was an increase in the value of the graphite phase intensity at $2\theta=26.56^\circ$ on the diffractogram. A large amount of graphite composition in the sample managed to reduce the energy value of the band gap with a successive test result value of 2.25; 1.84; 1.70; and 1.69 eV. Then, based on the test results, the electrical conductivity value in the cathode sample was included in the semiconductor material with a test value of up to 10^{-2} S/m .

Keywords : Band gap energy, functional groups, electrical conductivity, $\text{Na}_2\text{FeSiO}_4$, graphite, CMC, rice husk silica, crystal structure.