Fabrikasi dan karakterisasi Li4Ti5O12 untuk bahan anoda Baterai Lithium Keramik = Sinthesis and characterization of Li4Ti5O12 as anode material for lithium ceramic battery

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Abstrak

Telah dilakukan penelitian sintesa Li4Ti5O12 untuk aplikasi komponen anoda pada baterai lithium keramik. Sintesa dilakukan dengan metoda SSR (solid state reaction) dari bahan serbuk Li2CO3 dan TiO2. Percobaan dilakukan untuk mendapatkan optimasi parameter sintesa, yaitu dengan melakukan variasi suhu sinter dan lama waktu penahanan sinter. Proses diawali dengan kalsinasi pada suhu 700oC selama 1 jam. Kemudian dilakukan penggerusan dengan mortal hingga lolos 200 mesh. Sebelum disinter terlebih dahulu serbuk dipastakan dalam larutan metanol 99% sebagai pendispersi sehingga diharapkan campuran homogen. Variasi suhu sinter dilakukan pada suhu 750°C, 800°C, 850°C, 900°C dan 950°C masingmasing selama 2 jam. Sedangkan variasi waktu dilakukan pada suhu sinter 850°C dengan variasi waktu 1jam, 4 jam dan 8 jam. Identifikasi fasa yang terbentuk dilakukan dengan XRD, struktur mikro dengan SEM/EDX, konduktifitas grain dan grain boundary dengan spektrum impedansi AC. Untuk mengetahui porositas dan densitas dilakukan untuk pengujian dengan mengacu pada standar ASTM C 20-92. Sifat mekanik bahan dipelajari dari uji kekerasan mikrohardness dengan metoda Vickers. Dari penelitian ini didapatkan konduktifitas listrik tertinggi adalah ~ 1.0 10-7 S/cm dihasilkan dari suhu 850oC selama 2 jam. Prototip baterai lithium keramik telah dibuat LTO/LATP/LMO dengan tambahan elektrolit LiClO4. Tegangan sel mampu mencapai 2.5 V pada first charging, sementara pengujian kapasitas charge/discharge menunjukkan kapasitas discharge maksimal hanya 7%. Sel baterai juga menunjukkan gejala self discharge.
<hr>Li4Ti5O12 as anode material for lithium ceramic battery has been synthesized. Synthesis has been done by solid state reaction (SSR) method with the powder of Li2CO3 and TiO2 as starting materials. Research has been done to get optimum parameters during the synthesizing anode material by varying sinter temperature and time. Synthesis of anode material was initiated by calcination process, where the mixture of Li2CO3 and TiO2 was heated at 700oC for 1 hour. The obtained material from this step was further ground and sieved 200 mesh. Methanol with a purity of 99% was added to the powder after grinding. The purpose of this step is to get a homogene mixture. The sinter process of this homogene mixture was done by heating this material with temperature variation of 750°C, 800°C, 850°C, 900°C and 950°C for 2 hours each. Varying sinter time of 1, 4, and 8 hours was done during sintering anode material at 850°C. The obtained phases from sintering was done by XRD, microstructure by SEM/EDX, and conductivity of grain and grain boundary by AC Impedance Spectroscopy. The porosity and density of the obtained material were determined, referring to ASTM C 20-92 standard measurement. The mechanical property was studied by microhardness with vickers method. This research showed that the anode material has a high electrical conductivity around 1.0 10-7 S/cm by sintering at 850oC for 2 hours. Prototype of lithium ceramic battery LTO/LATP/LMO was made with an addition of LiClO4. Battery performance was analyzed by charge/discharge capacity test. Cell voltage at first cycle was excellently reach about 2.5 Volt. It showed that the maximum discharge capacity of the cell was only 7% from charge capacity. The cell also showed a self discharge phenomenon.