Studi pengaruh variasi waktu pencampuran terhadap pelat bipolar karbon komposit dengan penambahan 5 wt MWCNT = Study of influences of mixing time variation of bipolar plate carbon composite with the addition of 5wt MWCNT

Rizki Pirsiani, author

Abstrak

Sel tunam merupakan energi alternatif penghasil listrik yang dapat menggantikan peran energi bahan bakar fosil karena prosesnya yang ramah lingkungan. Salah satu jenis sel tunam adalah PEMFC (Polymer Electrolyte Membrane Fuel Cell). Dalam PEMFC terdapat komponen penting yang disebut dengan pelat bipolar. Pelat bipolar memenuhi 80% volume, 70% bobot, dan 60% biaya pembuatan sel tunam. Pada penelitian ini dibuat pelat bipolar karbon/karbon komposit dengan 80%wt matriks dan penguat yang terdiri dari 95%wt grafit dapur busur listrik (EAF) dan 5%wt MWCNT (Multi Walled Carbon Nanotubes) dan 20%wt polimer sebagai pengikat yang terdiri dari epoksi resin dan hardener dengan perbandingan 1:1. Pembuatan pelat bipolar ini memvariasikan waktu pencampuran yaitu 30 detik, 60 detik, 90 detik, 120 detik, dan 150 detik. Proses pencampuran menggunakan pengaduk berkecepatan tinggi dengan kecepatan 28.000 rpm dan dicetak menggunakan metode cetak kompresi dengan tekanan 55 MPa, suhu 100oC, selama 4 jam. Hasil penelitian menunjukkan bahwa waktu pencampuran optimum pada 30 detik dimana dihasilkan nilai densitas sebesar 1,61 gr/cm3, porositas 0,30%, kekuatan fleksural 51,29 MPa, dan konduktivitas listrik 7,53 S/cm. Sampel hasil uji fleksural diamati perpatahaannya dengan FESEM (Field Emission Scanning Electron Microscope). Hasil pengamatan menunjukkan pencampuran cukup optimum namun masih banyak MWCNT yang beraglomerat.

.....Fuel cell is one of alternative energy that produces electricity and can replace the use of fossil fuel because fuel cell is zero emission. Fuel cell has many types and one of them is PEMFC (Polymer Electrolyte Membrane Fuel Cell). In PEMFC, the important part is called bipolar plate. Bipolar plate meets the 80% volume, 70% weight and 60% cost of fuel cell fabrication.

In this study, the bipolar plate material made of carbon/carbon composites. Constituent materials of carbon/carbon composites were 80wt% matrix and reinforcement consist of 95wt% Graphite EAF (Electric Arc Furnace) and 5wt% MWCNT (Multi Walled Carbon Nanotubes) and 20wt% polymer as binder consist of epoxy resin and hardener with ratio 1:1. All materials were mix together with various mixing time. The variables of mixing time were 30 seconds, 60 seconds, 90 seconds, 120 seconds, and 150 seconds. The mixing process used high-speed mixer with mixing speeds 28.000 rpm and to form the plate used compression molding with pressure 55 MPa, 100°C, for 4 hours.

The test results showed that the optimum mixing time was 30 seconds which resulted density value was 1,61 gr/cm3, the percentage of porosity was 0,30%, the flexural strength was 51,29 MPa, and the electrical conductivity was 7,53 S/cm. Surface of flexural testing samples were observed with FESEM (Field Emission Scanning Electron Microscope). Observations using FESEM showed mixing at that time was optimum enough but still a lot of MWCNT forming as agglomerates.