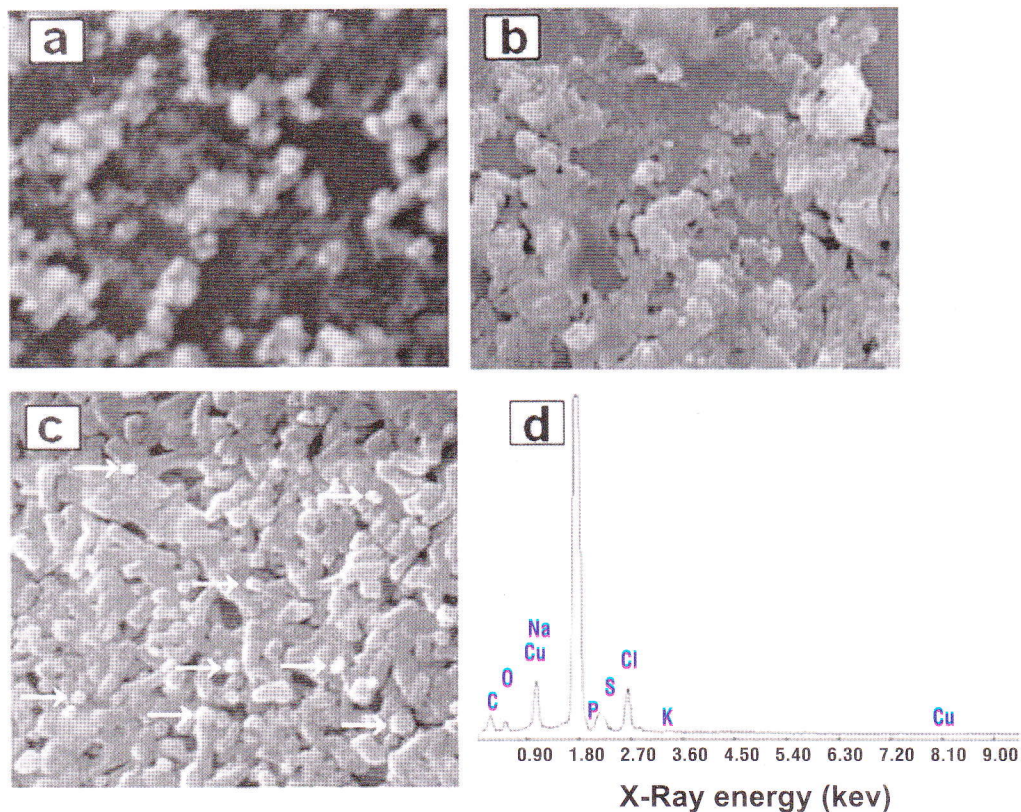


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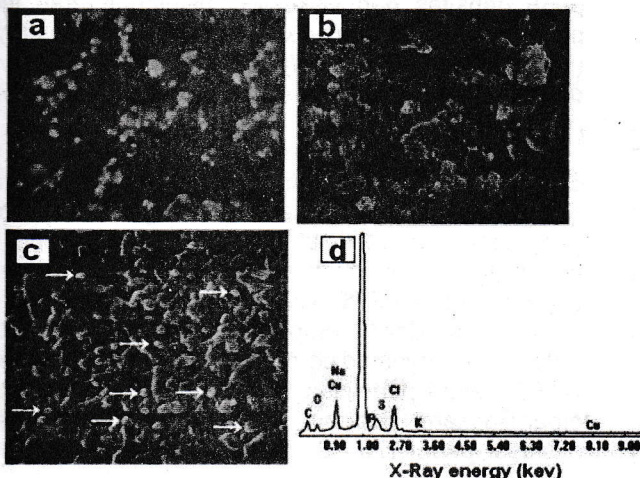
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Cover picture :

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a, b) SEM images recorded from two different regions of drop coated films of copper oxide obtained after 42 h. reaction of CuSO_4 with *Phormidium cyanobacterium*. c) CONPs present over *Phormidium cyanobacterium* biomass (arrows). d) EDAX spectrum recorded from a drop-coated film of an aqueous solution incubated with *Phormidium cyanobacterium* and treated with CuSO_4 ions for 42 h.

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LEAD ACID BATTERY MODELING FOR ELECTRIC CAR POWER SOURCES

Pemodelan Baterai Asam (Lead Acid Battery) Sebagai Sumber Energi Mobil Listrik

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ABSTRACT

Successful commercialization of electric vehicles will require a confluence of technology, market, economic, and political factors that transform EVs into an attractive choice for consumers. The characteristics of the traction battery will play a critical role in this transformation. The relationship between battery characteristics such as power, capacity and efficiency, and EV customer satisfaction are discussed based on real world experience. A general problem, however, is that electrical energy can hardly be stored. In general, the storage of electrical energy requires its conversion into another form of energy. Electrical energy is typically obtained through conversion of chemical energy stored in devices such as batteries. In batteries the energy of chemical compounds acts as storage medium, and during discharge, a chemical process occurs that generates energy which can be drawn from the battery in form of an electric current at a certain voltage. A computer simulation is developed to examine overall battery design with the MATLAB/Simulink. Battery modelling with this program have error level less than 5%.

Keywords: Electrochemistry, lead acid battery, stored energy

PENDAHULUAN

Mobil dengan bahan bakar minyak (BBM) berkembang seiring dengan rendahnya harga minyak dunia saat itu sehingga kebutuhan BBM untuk mobil semakin lama semakin meningkat. Sementara itu cadangan energi bahan bakar minyak (BBM) kian menipis [1-2]. Mobil yang digerakkan dengan mesin bakar (*internal combustion engine/ICE*) akan menghasilkan emisi gas buang yang berpotensi menimbulkan polusi udara sebagaimana disampaikan oleh *Environmental Protection Agency* (EPA). Gas buang yang dihasilkan oleh mobil dengan mesin bakar terdiri dari 18% partikel padat, 27% merupakan campuran bahan mudah menguap (terdiri 28% Pb, 32% NO dan 62% CO) serta CO₂ sebanyak 25% [3]. Polusi udara berdampak pada lingkungan [4] dan kesehatan manusia [5].

Penghematan bahan bakar minyak pada sektor transportasi serta isu *global warming* mendorong perlunya dikembangkan alat transportasi yang hemat BBM dan ramah lingkungan. Dari permasalahan ini perlu dicari sumber energi alternatif sebagai sumber energi yang digunakan untuk menggerakkan mobil serta teknologi penggerak mobil yang tidak menggunakan motor bakar. Salah satu upaya untuk mengurangi ketergantungan pada BBM dan mengurangi polusi lingkungan hidup adalah membuat mobil listrik.

Mobil listrik umumnya mendapatkan sumber energi listrik dari baterai. Baterai tersebut adalah suatu sel elektrokimia yang terdiri dari empat komponen dasar

yaitu elektroda positif, elektroda negatif, larutan elektrolit, dan *separator/pemisah* yang berfungsi sebagai isolasi antara elektroda positif dan negatif. Reaksi kimia antara elektroda dengan larutan elektrolit akan menghasilkan potensial listrik. Beda potensial listrik antara elektroda positif dengan elektroda negatif akan menghasilkan tegangan sel baterai. Besarnya tegangan sel baterai ini ditentukan oleh jenis elektroda dan konsentrasi larutan elektrolit. Sedangkan kapasitas baterai adalah banyaknya muatan listrik yang dapat diperoleh dari suatu baterai yang nilainya tergantung pada banyaknya bahan aktif yang ada [6].

Baterai elektrokimia mempunyai arti penting dalam sistem energi listrik sebab mereka memberi makna dalam menyimpan energi dengan cara seketika. Sebagian dari penggunaan utama baterai yang tumbuh cepat berlangsung dalam dekade terakhir adalah sebagai sumber energi utama pada mobil listrik. Ada banyak jenis baterai yang sekarang ini digunakan atau dikembangkan untuk pemakaian praktis, yang semakin tersebar luas pemakaiannya adalah baterai asam Pb [7-10].

Prinsip dari baterai pada umumnya adalah memanfaatkan reaksi elektrokimia [6,11]. Suatu logam yang bersentuhan dengan suatu larutan yang mengandung ion menyebabkan aktivitas ion dalam fase logam dan dalam fase larutan akan berbeda, perbedaan ini akan menimbulkan gaya dorong untuk hilangnya atau diperolehnya Zn⁺² oleh logam itu (gambar 1). Logam melepaskan Zn⁺² ke dalam larutan,

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