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ENERGY CONVERSION & STORAGE MATERIALS- I

E-TUE-02

PREPARATION AND CHARACTERIZATION OF ZnCdSe THIN FILMS FOR SOLAR CELL APPLICATIONS,

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Development of semiconductors with tailored band gap is of immense interest in modern scientific research. II-VI compound semiconductors and their alloys are suitable for photovoltaic and photoelectrochemical solar cell applications owi ng to their band gap and stability in polysulphide and polyiodide electrolytes. In this report, the electrosynthesis and characterization of ZnCdSe thin films for the photoelectrochemical solar cell applications are described.. ZnCdSe thin films are prepared potentiostatically at various temperatures in the potential range of -700 to -1100 mV versus saturated calomal electrode onto titanium and tin oxide coated conducting glass plates. A platinum foil is used as counter electrode. Cyclic voltammetric studies were carried out along with linear sweep voltammetry to select the deposition potential range. The synthesised films are characterised for their structural, optical, electrical, compositional and photoelectrochemical behaviour. The films deposited at a deposition potential of -900 mV versus SCE, by maintaining the bath temperature and pH as 75℃ and 2 respectively are found to be smooth and uniform.

E-TUE-03

FABRICATION IN A SINGLE SYNTHETIC STEP OF LiNi03 AND LiCoO2 FILMS IN LiOH SOLUTION OVER 20"C,

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Well crystallized and electrochemically active $LiNiO_2$ and $LiCoO_2$ *thin-film electrodes for lithium rechargeable microbatteries were* fabricated in a single synthetic step using an economical, energy and material efficient and environmentally friendly "Soft Solution Processing" in a concentrated LiOH solution at fixe temperatures over 20℃ without any postsynthesis annealing. While the purely hydrothermal treatment of cobalt substrates directly leads to the formation of $LiCoO_2$ films, by the use of the electrochemical-hydrothermal approach under supplementary galvanostatic charge with the same hydrothermal conditions, $LiNiO_2$ films can only effectively be prepared in a single synthetic step out of nickel substrates. Such difference in designed combination of activation methods can be ascribed to the different metal cation valency between dissolved nickel species (that contain divalent nickels) and dissolved cobalt species (that should possess trivalent cobalts). The prepared films exhibit a prospective electrochemical activity, however, the film property is dependent on the synthetic conditions.. In the fabrication of $LiCoO_2$ films in particular, while spinel (space group Fd3m) $LiCoO_2$ films were prepared under 10 0℃, layered (space group R3m) $LiCoO_2$ films were prepared over 100℃.

E-TUE-04

THE ELECTICAL TRANSPORT PROPERTIES AND OXYGEN NONSTOICHIOMETRY OF DONOR DOPED $Y(Fe_{1-x}Ti_x)O_{3-\delta}$

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Perovskite-type oxide, Ca-doped $YFeO_3$ has good electrochemical properties as a new candidate cathode material for solid oxide fuel cell (SOFC) applications. This system was chosen due to its material commonality with YSZ electrolyte, good mixed conductivity, and higher phase stability. Isothermal variation of ionic conductivity of $(Y_{1-x}Ca_x)FeO_{3-\delta}$ system shows positive dependence on oxygen partial pressure at high Po_2 range, which can be interpreted on the basis of anti-Frenkel disorder. Oxygen nonstoichiometry measurements of $(Y_{1-x}Ca_x)FeO_{3-\delta}$ system, however, did not give direct evidence for the existence of oxygen interstitial. In order to confirm the existence of oxygen interstitial in $YFeO_3$ system, donor doped system, Ti doped $YFeO_{3-\delta}$(YFT), was considered. Perovskite-type oxide, YFT, was investigated to determine if it has superior cathode properties for SOFC application also. To evaluate its electrochemical properties as cathode material for SOFC, total electrical conductivity, thermoelectric power and oxygen nonstoichiometry of YFT were measured as functions of temperature ($900 \leq T/℃ \leq 1100$) and oxygen partial pressure ($10^{-16} \leq Po_2/atm \leq 0.21$).

E-TUE-05

SYNTHESIS AND PROPERTIES OF CERAMICS-POLYMER COMPOSITE MEMBRANES AS HIGH TEMPERATURE PROTONIC CONDUCTING ELECTROLTYES.

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The synthesis of new proton-conducting polymer electrolyte for higer operating temperatures is reported and the conductive properties at the elevated temperature with various humidities have been investigated.

SiO_2/Polyethyleneoxide(PEO) ceramic-polymer composite (CPC) is a remarkable family of isotropic, amorphous, nanocomposite materials. The rigid silica domain in the composite results in high strength and temperature toughness while the PEO chain serve to provide flexibility and melt processibility. The CPC doped with monododecylphosphate (MDP) at different rates are casted from the mixed solution and the membrane are dried at ambient temperature. The Silver electrodes are attached on both sides of the membrane and protonic conductivities are measured at elevating temperatures and various humidities.

Proton conducting properties of CPC doped with MDP in the temperature range from 60℃ to 160℃. The protonic conductivity decreases with elevating temperature although the conductivity of approximately 10^{-4} S/cm is achieved at 160℃. The ecomonics of the basic materials can help replacement of the Nafion membrane.