SYNTHESIS AND ELECTROCHEMICAL PROPERTIES OF $LiCoO_2$ CATHODE WITH GRAPHITE OR GRAPHENE ANODE FOR AQUEOUS RECHARGEABLE LITHIUM BATTERIES

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by

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LIST OF ABBREVIATIONS

ARLB	Aqueous Rechargeable Lithium Batteries
CD	Charge-discharge
CE	Counter Electrode
CV	Cyclic Voltammetry
TGA	Thermogravimetric analysis
DTA	Differential thermal analysis
DTG	Derivative Thermogravimetry
EIS	Electrochemical Impedance Spectroscopy
FESEM	Field-Emission Scanning Electron Microscope
TEM	Transmission Electron Microscope
GoF	Goodness of Fit
R_{wp}	Weighted R Profile
JCPDS	Joint Committee on Powder Diffraction Standards
ICSD	Inorganic Crystal Structure Database
R_{ct}	Charge Transfer Resistance
R_s	Electrolyte Resistance
RE	Reference Electrode
SCE	Saturated Calomel Electrode
WE	Working Electrode
XRD	X-ray Diffraction
EC/DEC	Ethylene carbonate-diethyl carbonate
ED/DMC	Ethylene carbonate-dimethyl carbonate
H_2	Hydrogen
H_2O	Water

$C_2H_3LiO_2.2H_2O$	lithium acetate dihydrate
$C_4H_6CoO_4.4H_2O$	cobalt acetate tetrahydrate
C_6H_8O	citric acid
$LiCoO_2$	Lithium cobalt oxide
$LiFePO_4$	Lithium iron phosphate
$LiMn_2O_4$	Lithium manganese oxide
$LiNO_3$	Lithium nitrate
LiOH	Lithium hydroxide
Li_2SO_4	Lithium sulphate
Li_3PO_4	Trilithium phosphate
LiV_3O_8	Lithium vanadium oxide
N_2	Nitrogen
O_2	Oxygen
Pt	Platinum
PTFE	polytetrafluoroethylene
PVDF	polyvinylidene fluoride
SS mesh	Stainless steel mesh

LIST OF SYMBOLS

%	Percentage
<	Less than
>	More than
°	Degree
Ω	Ohm
λ	Wave length
wt. %	Weight percent
mA h g^{-1}	Mili-ampere hour per gram
Wh kg^{-1}	Watt hour per kilogram
°C	Degree Celsius
°C min^{-1}	Degree Celsius per minute
A	Ampere
C	Current rate
cm	Centimeter
nm	Nanometer
eV	Electron volt
g	Gram
h	Hour
Hz	Hertz
K	Kelvin
Li^{+}	Lithium ions
V	Voltage

SINTESIS DAN PENCIRIAN ELEKTROKIMIA KATOD $LiCoO_2$ DENGAN GRAFIT ATAU GRAFIN ANOD UNTUK BATERI AKUES LITIUM YANG BOLEH DICAS SEMULA

ABSTRAK

Bateri akues litium yang boleh dicas semula kini mendapat perhatian kerana kos pengeluaran yang lebih rendah dan keselamatan penyimpanan tenaga yang lebih baik**.** Bahan katod dengan pemilihan parameter sintesis yang sesuai merupakan salah satu faktor yang akan menghasilkan sifat bahan yang baik dan pada masa yang sama turut membantu dalam mencapai prestasi elektrokimia yang lebih baik. Dalam kajian ini, kesan masa pengacauan dan masa sonikasi dikaji dalam mensintesis $LiCoO_2$ melalui kaedah sol-gel. Keputusan pencirian bahan antara sampel optima pada masa kacau (30 jam) dan sampel optima pada masa sonikasi (120 minit) menunjukkan sampel yang disintesis melalui proses sonikasi adalah lebih baik berbanding proses pengacauan dengan sifat penghabluran yang terbaik dan saiz zarah yang terkecil. Analisis morfologi menunjukkan taburan saiz zarah adalah dalam julat 0.29 - 0.43 μm. Tingkah laku kitaran $LiCoO_2$ yang disintesis melalui sonikasi dengan grafin sebagai anod mempamerkan kestabilan kitaran yang lebih baik, puncak redoks yang jelas dan beza keupayaan yang kecil (0.13 V). Prestasi bateri $LiCoO_2$ menunjukkan penambahan kapasiti pelepasan khusus (122.43 mAh g^{-1} pada 0.5 C) dan kebolehulangan dalam elektrolit akues. Peningkatan prestasi elektrokimia disokong oleh analisis impedans. Perbezaan kecil (0.7 Ω) dalam rintangan pemindahan cas sebelum dan selepas analisis cas-discas menunjukkan bahawa ion Li^+ telah tersebar dengan baik semasa proses interkalasi/nyah-interkalasi.