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ABSTRACT

The present thesis aims at describing the corrosion behaviour of metal samples under the influence of acid and its possible protective strategy. Corrosion, an unavoidable process accompanied with huge economical loss has paved a platform to identify suitable research problem.

To commence with, a series of linear aliphatic and aromatic polyesters were synthesised and structurally characterised by FT-IR, ^{1}H-NMR and ^{13}C-NMR studies. TGA and DSC techniques were adopted to study its thermal response followed by its evaluation in protecting the mild steel in 0.5 M H_2SO_4. Moderate inhibition efficiency of aliphatic polyesters was enhanced by adopting a green approach, where nano metal oxides were dispersed using *Persia Americana*. Selected inhibitors were tested for their inhibitive action in 1 M HCl and 0.3 M H_3PO_4 in addition to 0.5 M H_2SO_4 and the results were compared. Inhibition under chloride induced medium was investigated using selected inhibitors in presence of simulated concrete pore solution. Studies adopted to protect the metals was assessed by mass loss method, electrochemical impedance spectroscopy and potentiodynamic polarisation technique. Methods used were in good agreement with each other with an end result of mitigating corrosion. To strengthen the results, morphological studies were carried out using XRD, SEM, EDS, AFM and XPS analysis. Additionally, the degradation behaviour of Ti-6Al-4V alloy in simulated body fluid medium was also monitored using electrochemical techniques along with surface studies. Attempts made and discussed in the above mentioned areas are elaborated in Part-A of this thesis.

Part-B of this thesis explores the application of synthesised polyester as electrolyte in energy storage device using solution casting technique with a base of poly vinyl alcohol and dopant. Surface and elemental composition of the synthesised electrolyte was revealed from scanning electron microscopy and energy dispersive x-ray spectroscopy. Conductivity of the electrolyte was measured using AC impedance analyser and its transference number was calculated to reveal the contribution of charged species within the polymer electrolyte. Detailed review made is documented in the respective chapters followed by the summary and conclusions in chapter - X.

ABBREVIATIONS AND SYMBOLS

Θ	-	Surface coverage
CR	-	Corrosion rate
NMR	-	Nuclear magnetic resonance spectroscopy
DSC	-	Differential scanning calorimetry
T_g	-	Glass transition temperature
TGA	-	Thermo gravimetric analysis
C_{dl}	-	Double layer capacitance
R_{ct}	-	Charge transfer resistance
f_{max}	-	Frequency maximum
b_a, b_c	-	Anodic and cathodic Tafel slopes
E_{corr}	-	Corrosion potential
Icorr	-	Corrosion current
$\mu F/cm^2$	-	microfarads / cm^2
OCP	-	Open circuit potential
ppm	-	Parts per million
R	-	Gas constant
FT-IR	-	Fourier transform Infrared spectroscopy
SEM	-	Scanning electron microscopy
EDS	-	Energy dispersive X-ray spectroscopy
XRD	-	X-ray diffraction spectroscopy
AFM	-	Atomic force microscopy
XPS	-	X-ray photoelectron spectroscopy
Z'	-	Real part of impedance
Z''	-	Imaginary part of impedance
R_b	-	Bulk resistance
ε*	-	Complex permittivity
M*	-	Complex electrical modulus
t_+, t_{ele},	-	Transference number of cation and anion
I_i, I_f	-	Initial and final current

N	-	Avogadro number
μ, μ_+ and μ_-	-	Total, cationic and anionic mobility
σ	-	Conductivity
D_+, D_-	-	Diffusion co-efficient of cation and anion
OCV	-	Open circuit voltage

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