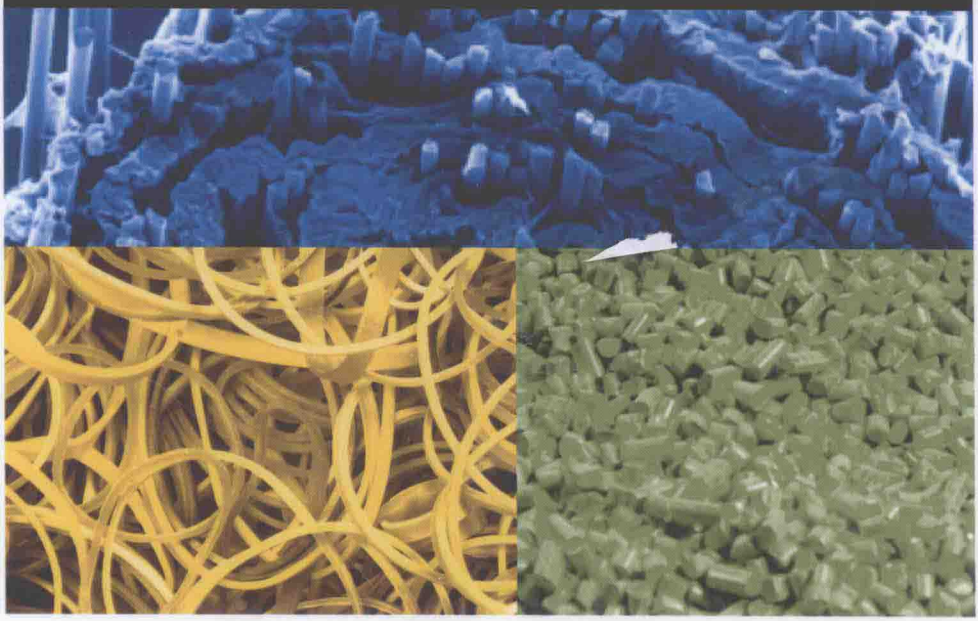
Materials Science of Polymers

Plastics, Rubber, Blends, and Composites



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LIST OF ABBREVIATIONS

AFM	atomic force microscopic
ANN	artificial neural network
ASA	active surface area
CA	contact angle
CCBB	continuous configurational boltzmann biased
CCD	central composite design
CP	conducting polymer
CVD	chemical vapor deposition
DB	degree of branching
DFT	density functional theory
DTA	differential thermal analysis
HBPs	hyperbranched polymers
EB	electron beam
EBID	electron-beam-induced deposition
EDS	X-ray energy dispersive spectroscopy
EDX	energy dispersive X–ray
EHT	energy of electrons
FTIR	fourier transform infrared spectroscopy
HA	hyaluronic acid
HBPs	hyperbranched polymers
LDA	local density approximation
MC	monte carlo
MD	molecular dynamics
NEMD	non-equilibrium molecular dynamics
NNG	natural source
OIT	oxidation induction time
PEMFCs	proton exchange membrane fuel cells
PET	poly(ethylene terephthalate)
PUE	polyurethane elastomers
RSM	response surface methodology
SAD	selected-area diffraction
SBR	styrene-butadiene rubber
SEM	scanning electron microscope
SFE	surface free energy
SiC	silicon carbide
TBMD	tight bonding molecular dynamics

TEM	transmission electron microscope
TES	tear strength
TGA	thermogravimetric analyzer
TS	tensile strength

LIST OF SYMBOLS

a	water activity
C	molar concentration (mol/m3)
D	mass diffusion coefficient (m2/s)
F	faraday constant (C/mol)
I	local current density (A/m2)
J	exchange current density (A/m2)
K	permeability (m2)
M	molecular weight (kg/mol)
n_d	electro-osmotic drag coefficient
P	pressure (Pa)
R	universal gas constant (J/mol-K)
T	temperature (K)
t	thickness
$\vec{u}$	velocity vector
Vcell	cell voltage
Voc	open-circuit voltage
W	width
X	mole fraction

Greek letters

ρ	water transfer coefficient
ρ	effective porosity
ρ	density (kg/m3)
μ	viscosity (kg/m-s)
σ_e	membrane conductivity (1/ohm-m)
λ	water content in the membrane
η	stoichiometric ratio
η	over potential (v)
λ_{eff}	effective thermal conductivity (w/m-k)
ϕ_e	electrolyte phase potential (v)

SUBSCRIPTS AND SUPERSCRIPTS

a	anode
c	cathode

ch	channel
k	chemical species
m	membrane
MEA	membrane electrolyte assembly
ref	reference value
sat	saturated
w	water

PREFACE

This book skillfully blends and integrates polymer science, plastic technology and rubber technology. The fundamentals of polymerization, polymer characteristics, rheology and morphology as well as the composition, technology, testing and evaluation of various plastics, rubbers, fibers, adhesives, coatings and composites are comprehensively presented. The book is highly suitable for all entrepreneurs and professionals engaged in production of as well as research and development in polymers. It will also be found immensely useful by advanced- level research students of physics, chemistry, and materials science, specializing in polymers, as well as students of chemical and metallurgical engineering having courses in polymer technology/materials science and technology.

This volume highlights the latest developments and trends in advanced polyblends and their structures. It presents the developments of advanced poly-blends and respective tools to characterize and predict the material properties and behavior. The book provides important original and theoretical experimental results that use nonroutine methodologies often unfamiliar to many readers. Furthermore chapters on novel applications of more familiar experimental techniques and analyses of composite problems are included, which indicate the need for the new experimental approaches that are presented.

Technical and technological development demands the creation of new materials that are stronger, more reliable, and more durable, i.e. materials with new properties. Up-to-date projects in creation of new materials go along the way of nanotechnology.

With contributions from experts from both industry and academia, this book presents the latest developments in the identified areas. This book incorporates appropriate case studies, explanatory notes, and schematics for more clarity and better understanding. This book will be useful for chemists, chemical engineers, technologists, and students interested in advanced nanopolymers with complex behavior and their applications.

This new book:

- Gives an up-to-date and thorough exposition of the present state of the art of polyblends and composites.
- Familiarizes the reader with new aspects of the techniques used in the examination of polymers, including chemical, physicochemical, and purely physical methods of examination.
- Describes the types of techniques now available to the polymer chemist and technician and discusses their capabilities, limitations, and applications.

- Provides a balance between materials science and mechanics aspects, basic and applied research, and high-technology and high-volume (low cost) composite development.

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