Applied Methodologies in Polymer Research and Technology

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Edited by

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Gennady E. Zaikov, DSc, and A. K. Haghi, PhD

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APPLIED METHODOLOGIES IN POLYMER RESEARCH AND TECHNOLOGY

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LIST OF ABBREVIATIONS

ACs	active sites
CS	cuckoo search
DAC	dialdehyde cellulose
DAGA	diallylguanidine acetate
DAGTFA	diallylguanidine trifluoroacetate
DE	differential evolution
DLS	dynamic light scattering
DSS	dextran sulfate sodium salt
ESEM	environment scanning electron microscope
FPLC	fast protein liquid chromatography
MCC	microcrystalline cellulose
MWD	molecular weight distribution
NPBA	neutral polymeric bonding agent
OM	optical microscopy
PHB	poly(3-hydroxybutyrate)
PMMA	poly (methylmethacrylate)
PSO	particle swarm optimization
SA	sodium alginate
SALS	small angle light scattering
SC	sodium caseinate
SPEUs	segmented polyetherurethanes

LIST OF SYMBOLS

δ_1 and δ_2	Hildebrand's parameters
ρ_2	density of a polymer into solution
V_1	molar volume of the solvent
T_m	melting temperature
P_{max}	maximum pressure of each isotherm
S	number of point per isotherm per gas
C_{exp}	methane concentrations (experimental)
C_{cal}	methane concentrations (calculated)
U_e	electrophoretic mobility
ε	dielectric constant
η	viscosity
$z\rho$	zeta potential
k	Boltzmann's constant
T	temperature
n	dumbbells density
p	unit vector in nanoelement axis direction
ω_{ij}	rotation rate tensor
γ_{ij}	deformation tensor
D_r	rotary diffusivity
θ	shape factor
l	mean segment length
V	velocity
h	fabric thickness
m	equivalent mass
α	surface charge parameter

PREFACE

Polymers are substances that contain a large number of structural units joined by the same type of linkage. These substances often form into a chain-like structure. Starch, cellulose, and rubber all possess polymeric properties. Today, the polymer industry has grown to be larger than the aluminum, copper, and steel industries combined. Polymers already have a range of applications that far exceeds that of any other class of material available to man. Current applications extend from adhesives, coatings, foams, and packaging materials to textile and industrial fibers, elastomers, and structural plastics. Polymers are also used for most nanocomposites, electronic devices, biomedical devices, and optical devices, and are precursors for many newly developed high-tech ceramics.

This book presents leading-edge research in this rapidly changing and evolving field. Successful characterization of polymer systems is one of the most important objectives of today's experimental research of polymers. Considering the tremendous scientific, technological, and economic importance of polymeric materials, not only for today's applications but for the industry of the twenty-first century, it is impossible to overestimate the usefulness of experimental techniques in this field. Since the chemical, pharmaceutical, medical, and agricultural industries, as well as many others, depend on this progress to an enormous degree, it is critical to be as efficient, precise, and cost-effective in our empirical understanding of the performance of polymer systems as possible. This presupposes our proficiency with, and understanding of, the most widely used experimental methods and techniques. This book is designed to fulfill the requirements of scientists and engineers who wish to be able to carry out experimental research in polymers using modern methods.

Polymer nanocomposites are materials that possess unique properties. These properties are enhanced properties of the polymer matrix. Some of the improved properties are thermal stability, permeability to gases, flammability, mechanical strength and photodegradability. At complete dispersion of the new layers in the polymer matrix, these enhanced properties are obtained. The unique properties of the material makes it suitable in applications as, food and beverage packaging, automobile parts, furniture, carrier bags, electrical gadgets, and so on.