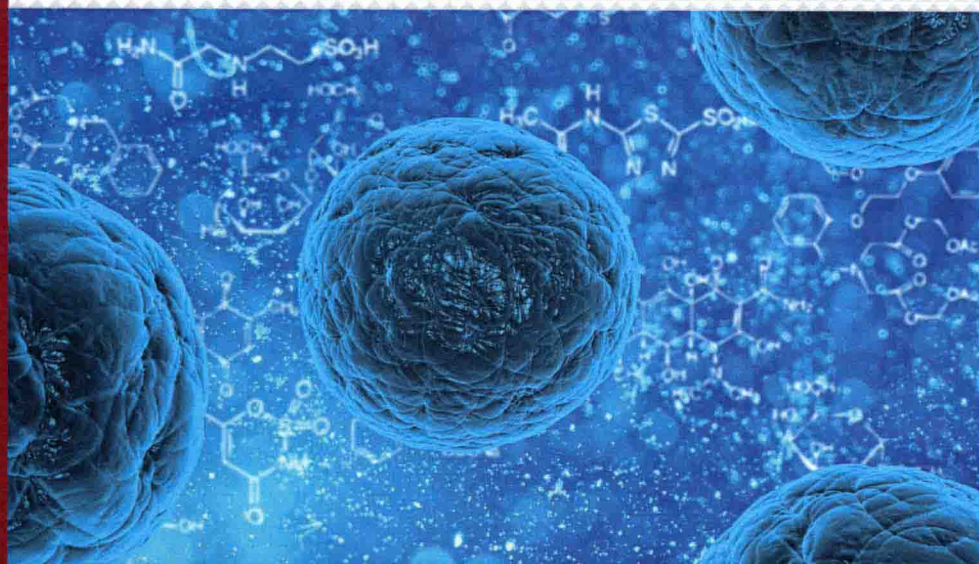


Volume 1

# Physical Chemistry Research for **Engineering** and **Applied Sciences**

Principles and Technological Implications



Editors

Eli M. Pearce, PhD

Bob A. Howell, PhD

Richard A. Pethrick, DSc, PhD

Gennady E. Zaikov, DSc

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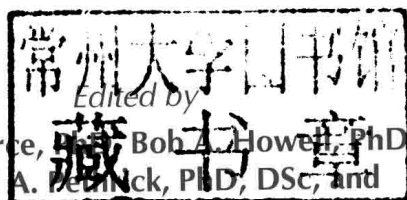


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Richard A. Pettinck, PhD, DSc, and  
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RESEARCH FOR ENGINEERING  
AND APPLIED SCIENCES**

**VOLUME 1**

Principles and Technological Implications



# ABOUT THE EDITOR

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## **Eli M. Pearce, PhD**

Dr. Eli M. Pearce was the President of the American Chemical Society. He served as Dean of the Faculty of Science and Art at Brooklyn Polytechnic University in New York, as well as a Professor of Chemistry and Chemical Engineering. He was the Director of the Polymer Research Institute, also in Brooklyn. At present, he consults for the Polymer Research Institute. As a prolific author and researcher, he edited the *Journal of Polymer Science* (Chemistry Edition) for 25 years and was an active member of many professional organizations.

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Bob A. Howell, PhD, is a Professor in the Department of Chemistry at Central Michigan University in Mount Pleasant, Michigan. He received his PhD in physical organic chemistry from Ohio University in 1971. His research interests include flame-retardants for polymeric materials, new polymeric fuel-cell membranes, polymerization techniques, thermal methods of analysis, polymer-supported organoplatinum antitumor agents, barrier plastic packaging, bioplastics, and polymers from renewable sources.

## **Richard A. Pethrick, PhD, DSc**

Professor R. A. Pethrick, PhD, DSc, is currently a Research Professor and Professor Emeritus in the Department of Pure and Applied Chemistry at the University of Strathclyde, Glasgow, Scotland. He was Burmah Professor in Physical Chemistry and has been a member of the staff there since 1969. He has published over 400 papers and edited and written several books. Recently, he has edited several publications concerned with the techniques for the characterization of the molar mass of polymers and also the study of their morphology. He currently holds a number of EPSRC grants and is involved with Knowledge Transfer Programmes involving three local companies involved in production of articles made out of polymeric materials. His current research involves AWE and has acted as a consultant for BAE Systems in the area of explosives and a company involved in the production of anticorrosive coatings.

Dr. Pethrick is on the editorial boards of several polymer and adhesion journals and was on the Royal Society of Chemistry Education Board. He is a Fellow of the Royal Society of Edinburgh, the Royal Society of Chemistry, and the Institute of Materials, Metal and Mining. Previously, he chaired the 'Review of Science Provision 16-19' in Scotland and the restructuring of the HND provision in chemistry. He was also involved in the creation of the revised regulations for accreditation by the Royal Society of Chemistry of the MSc level qualifications in chemistry. For a many years, he was the Deputy Chair of the EPSRC IGDS panel and involved in a number of reviews of the courses developed and offered under this program. He has been a member of the review panel for polymer science in Denmark and Sweden and the National Science Foundation in the USA.

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# Physical Chemistry Research for Engineering and Applied Sciences in 3 Volumes

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Physical Chemistry Research for Engineering and Applied Sciences:  
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# LIST OF ABBREVIATIONS

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AOS	Antioxidant System
ARE	Antioxidant-Response Element
BJH	Barrett-Joyner-Halenda
CaSt2	Calcium Stearate
CHD	Coronary Heart Disease
CLD	Chord-Length Distribution
COFs	Covalent Organic Frameworks
DFT	Density Functional Theory
DR	Dubin-Radushkevich
ENB	Ethylidene Norbornene
EPR	Electron Paramagnetic Resonance
FCC	Face-Centered Cubic
GCMC	Grand Canonical Montecarlo
GMS	Gentamicin Sulfate
HCP	Hexagonal Close-Packed
ISC	Iron-Sulfur Centers
IUPAC	Union of Pure and Applied Chemists
LPO	Lipid Peroxidation
MOFs	Metal Organic Frameworks
MOPs	Microporous Organic Polymers
MP	Mercury Porosimetry
NBR	Butadiene-Nitrile Rubber
NG	Nitroglycerine
NLDFT	Nonlocal Density Functional Theory
PALS	Positron Annihilation Lifetime Spectroscopy
Phr	Per Hundred of Rubber
PIMs	Polymers of Intrinsic Microporosity
PSD	Pore Size Distribution
ROS	Reactive Oxygen Species
SANS	Small Angle Neutron Scattering
SAS	Small-Angle Scattering
SAXS	Small-Angle X-rays Scattering
SEM	Scanning Electron Microscopy
TEM	Transmission Electron Microscopy
VEGF	Vascular Endothelial Growth Factor
WAS	Wide-Angle Scattering



# LIST OF SYMBOLS

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$\Phi$	angle of contact between liquid and walls
$a_m$	area of an adsorbate molecule
$a_p$	pore surface area
$b, c$	constant
$\theta$	contact angle
$D_e$	distribution function for pore diameter
$F$	meniscus shape factor
$F(\vec{S})$	atomic form factor
$K$	porod invariant
$l_p$	porod length
$M_v$	gram molecular volume
$N$	Avagadro's number
$n_m$	monolayer capacity
$P$	pressure
$P_0$	vapor pressure of the bulk liquid, ambient pressure
$R$	gas constant
$R_k$	Kelvin radius
$r_m$	mean radius of curvature of the liquid/gas interface
$S$	surface area
$S$	scattering vector
$S$	total pore surface
$S_{BET}$	specific surface area
$T$	temperature
$V$	volume adsorbed per unit mass of adsorbent, pore volume
$V_L$	molal liquid volume
$V_m$	volume adsorbed at the complete monolayer point
$v_p$	the pore volume
$V_{tot}$	total pore volume
$Z(\vec{S})$	lattice factor
$\gamma$	surface tension
$\lambda$	wavelength
$\rho_b$	bulk density
$\rho_p$	particle density
$\sigma$	liquid-gas surface tension
$\phi$	volume fraction of voids



