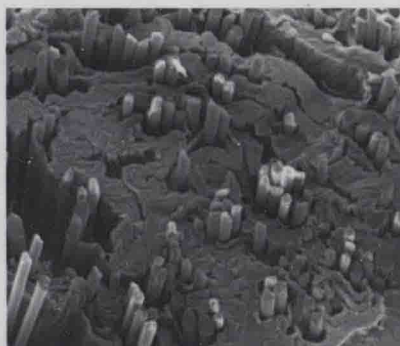


# Engineering Materials

Applied Research and  
Evaluation Methods



Ali Pourhashemi, PhD Editor



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# ENGINEERING MATERIALS

Applied Research and Evaluation Methods

*Edited by*

**Ali Pourhashemi, PhD**

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

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# **ENGINEERING MATERIALS**

Applied Research and Evaluation Methods



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# LIST OF ABBREVIATIONS

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AC	Asphalt Concrete
ACHF	Activated Carbon Hollow Fibers
ACNF	Activated Carbon Nanofiber
ACs	Activated Carbons
AF	Attractive Force
AN	Acrylonitrile
AP	Aromatic Polyesters
APP	Asymmetric Packing Process
BET	Brunner-Emmett-Teller
BJH	Barrett-Joiner-Halenda
CNF	Carbon Nanofibers
CNTs	Carbon Nanotubes
CVD	Chemical Vapor Deposition
DBTL	Dibutyl Tin Dilaurate
DCP	Dicumyl Peroxide
DDT	Dichlorodiphenyltrichloroethane
DF	Directional Force
DMF	Dimethyl Formaldehyde
DPPG	Diphenylpicrylhydrazyl
DSC	Differential Scanning Colorimetry
ED	External force-induced Directional factor
EDLC	Electrochemical Double-Layer Capacitors
EDXS	Energy dispersive X-ray spectrometry
EELS	Electron Energy Loss Spectroscopy
EF-F	External Force-specific Functional segment
EOE	Ethylene-Octane Elastomer
EPDM	Ethylene-Propylene-Diene Rubber
ESR	Electron Spin Resonance
EV	Electric Vehicles
F-BU	Fabrication Building Unit
FeS	Iron Sulphide
FET	Field Effect Transistors

FTIR	Fourier Transform Infrared
GIXRD	Grazing Incidence X-ray Diffraction
HK	Horvath–Kawazoe
HR	Heat Radiation
HTT	Heat-Treatment Temperature
iPP	Isotactic Polypropylene
LDPE	Low Density Polyethylene
LIB	Lithium Ion Battery
LQPs	Liquid-Crystal Polyesters
MFCs	Microbial Fuel Cells
MMA	Methyl Methacrylate
MSA	Molecular Self-Assembly
MWNTs	Multiwall Carbon Nanotubes
N-CE	Nano-Communication Element
NF	Nanofiltration
N-ME	Nano-Mechanical Element
N-PE	Nano-Property Element
N-SE	Nano-Structural Element
PAN	Polyacrylonitrile
PHEV	Plug-in Hybrid Electric Vehicles
PMMA	Poly (methyl methacrylate)
PP	Polypropylene
Pt	Platinum
PVDC	Polyvinylidene Chloride
R-BU	Reactive Building Unit
RF	Repulsive Force
RHR	Rate of Heat Release
SA-BU	Self-Assembly Building Unit
SAMs	Self-Assembled Monolayers
SBR	Styrene-Butadiene Rubber
SEM	Scanning Electron Microscopy
SMPE	Sulfohenyl Methallyl Ether
SSS	Sodium P-Styrene Sulfonate
SWNTs	Single Wall Carbon Nanotubes
TEM	Transmission Electron Microscopy
TGA	thermogravimetric analysis
TOF-SIMS	Time of Flight Secondary Ion Mass Spectroscopy
TPEs	Thermoplastic Elastomers

TPE-V	Thermoplastic Vulcanisates
VA	Vinyl Acetate
VLS	Vapor-Liquid-Solid



# LIST OF SYMBOLS

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$a$	attractive segment
$a(k)$	distribution of wave numbers
$a_s$	crack radius
$d$	directional segment
$d^3r$	volume element
$de$	exact differential energy
$dp$	probability
$dp_s$	differential entropy for macrosystems
$e$	modulus of elasticity
$E'$	storage modulus
$E''$	loss modulus
$i$	intensity
$k$	wave vector
$l$	long period
$m$	mass
$r$	repulsive segment
$S$	entropy for nano/small systems
$t_c$	crystallization
$tm$	temperature of melting
$v$	rate of crack propagation
$v_m$	limiting crack velocity

## Greek Symbols

$\Theta$	half of the scattering angle
$\rho$	material density
$\tau$	time interval
$v$	velocity
$\Delta h_m^\circ$	enthalpy of melting of polyethylene crystal
$\Delta h_m$	enthalpy of melting
$\Delta k$	stress intensity factor change
$\delta q_{in}$	inexact differential amounts of heat
$\delta w_{in}$	inexact differential amounts of work
$\Delta x$	spatial extension

$\psi$	wave function
$\lambda$	wavelength
$\epsilon_{100\%}$	tension at 100% elongation
$\epsilon_B$	relative elongation at the tear off
$\epsilon_y$	elongation on yield point
$\lambda$	wavelength of the x-rays
$\sigma_M$	maximum tension
$\sigma_y$	yield point
$\omega$	frequency