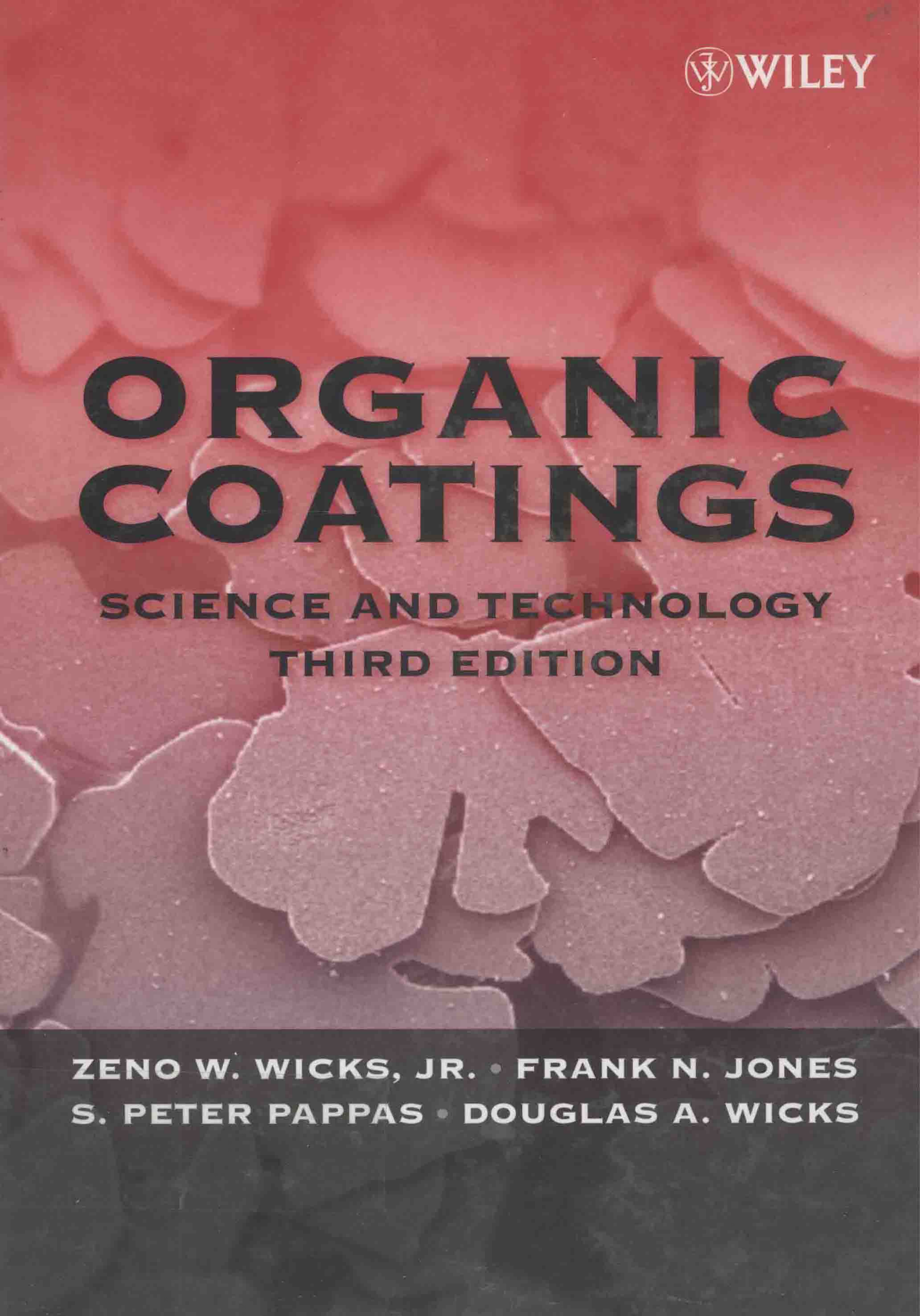

WILEY

ORGANIC COATINGS

SCIENCE AND TECHNOLOGY

THIRD EDITION

ZENO W. WICKS, JR. • FRANK N. JONES
S. PETER PAPPAS • DOUGLAS A. WICKS

Organic Coatings

Science and Technology

Third Edition

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Cover: Scanning electron micrograph of alumina flakes. Courtesy of F. J. Maile, G. Pfaff, and P. Reynders, Merck KGaA, Pigments R&D. Reprinted from *Progress in Organic Coatings*, Vol. 54(1), F. J. Maile, G. Pfaff, and P. Reynders, "Effect pigments—past, present, and future," pp. 150–163, 2005, with permission from Elsevier.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.

Library of Congress Cataloging-in-Publication Data:

Wicks, Zeno W.
Organic coatings : science and technology / Zeno W. Wicks, Jr., Frank N. Jones, S. Peter Pappas; consultant, Douglas A. Wicks.
p. cm.
Includes index.
ISBN 978-0-471-69806-7 (cloth)
1. Plastic coatings. I. Jones, Frank N., 1936– II. Pappas, S. Peter (Socrates Peter), 1936– III. Title.
TP1175.S6W56 2006
667′.9- -dc22 2006013297

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

Organic Coatings

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Preface

Significant advances have been made since the publication of the second edition of *Organic Coatings: Science and Technology*. The third edition has been completely updated. Our purpose remains the same, which is to provide a reference and textbook that interrelates coatings technology with current scientific understanding.

Entire books could be written about the subject of each chapter, and many have been. To be as comprehensive as possible in the limited space available, we have had to limit coverage of each topic and have selected references for readers seeking more detailed information. We have striven to enhance the usefulness of this edition both as a classroom textbook on coatings science, as well as a reference book, by improving the presentation of each topic. The reader will benefit from having taken college level chemistry courses through organic chemistry, but no coursework in polymer science is assumed.

Many of the chapters include brief descriptions of coatings compositions and applications, supported by references, which could be omitted or used for outside assignments, such as term papers, particularly in an advanced course. These descriptions tend to be placed in the later sections of each chapter and tend to be more prevalent in the application chapters. These compositions and applications particularly enhance the value of the volume as a reference book and self-teaching text. We understand that the second edition was used widely for this purpose. We have also defined the jargon of coatings to help newcomers to the field understand its specialized language. Although the book is written specifically about coatings, many of the principles involved apply to the related fields of printing inks, adhesives, and parts of the plastics industry.

Coatings technology evolved empirically, by trial and error. The last few decades have seen a marked increase in scientific understanding of the applicable principles, but the complexities of the field are such that the formulator's art is still essential in developing and using coatings. The need to reduce air pollution while maintaining and, preferably, improving coating performance requires radically new formulations on a short time scale. Our conviction is that increased understanding of the underlying science can help formulators work more effectively and that an appreciation of a formulator's craft is essential for scientists working in the field.

We do not claim to provide a complete literature review on each topic, but believe that many of the key references are cited. Readers are cautioned that the quality of the literature in the coatings field is uneven. Many published papers and monographs are excellent, but some are not; unfortunately, some authors did not fully understand the complexity of the field.

Many of the chapters in this edition were reviewed by people with extensive working experience with the particular topic. These reviewers were: David Bittner, Randall Brady, Adelbert Braig, John Bright, David Cocuzzi, Nico Enthoven, Ray Fernando, Werner Funke, Loren Hill, George Pilcher, Bradley Richards, Christian Schaller, John G. Stauffer, and Peter Wolfgang. Special thanks to Clifford Schoff, who reviewed three chapters and a section of another. We acknowledge the contributions of students and staff from the Wicks and Thames/Rawlins Research Groups at the University of Southern Mississippi. Special appreciation is expressed for the assistance of Helen Rassier, Stacy Trey, and Todd Williams of the Wicks Research Group.

Symbols and Units

A	Arrhenius preexponential term
C	concentration, weight per unit volume of solution
°C	degrees Celsius
c	concentration, moles per liter
E	modulus; relative evaporation rate
E'	storage modulus (elastic modulus)
E''	loss modulus
E_a	thermal coefficient of reaction rate (Arrhenius activation energy)
F	functionality of a monomer
$\bar{F}$	average functionality of a monomer mixture
f	functionality of a polymer (resin)
$\bar{f}_n$	number average functionality of a polymer (resin)
G	free energy; Small's molar association constant; force applied in a tensile test
G_c	force to crack in a tensile test
g	gram
g	gravitational constant
H	enthalpy
h	film thickness
i	angle of incidence
K	Kelvin temperature
K	absorption coefficient

Note that all acronyms are listed in the index.

K_E	Einstein (shape) constant
k	rate constant
kg	kilogram
L	liter
M	molecular weight
$\bar{M}_c$	average molecular weight between cross-links
$\bar{M}_n$	number average molecular weight
$\bar{M}_w$	weight average molecular weight
mL	milliliter
mP·s	millipascal second = 1 centipoise
N	newton
N	number of moles; refractive index
P	vapor pressure, degree of polymerization
$\bar{P}_n$	number average degree of polymerization
$\bar{P}_w$	weight average degree of polymerization
p	extent of reaction
p_g	extent of reaction at gelation onset
Pa	pascal
Pa·s	pascal second = 10 poise
PDI	polydispersity index = $\bar{M}_w/\bar{M}_n$
R	gas constant
r	angle of reflection or angle of refraction
S	entropy; scattering coefficient
s	second
T	temperature; time
T_b	brittle–ductile transition temperature
T_g	glass transition temperature
T_m	melting point
tan δ	tan delta, loss tangent, E''/E'
V	molar volume
V_i	volume fraction of internal phase
w	weight fraction
X	film thickness
x	mole fraction
x	optical path length
γ	surface tension
$\dot{\gamma}$	shear rate
δ	solubility parameter; phase shift in viscoelastic deformation
ε	molar absorbance; strain
η	absolute shear viscosity
η_e	external phase viscosity; extensional viscosity
η_r	relative viscosity = η/η_s
η_s	viscosity of solvent
$[\eta]$	intrinsic viscosity
$[\eta]_w$	weight intrinsic viscosity
$[\eta]_\theta$	intrinsic viscosity under theta conditions

θ	contact angle
λ	wavelength
ν	kinematic viscosity; Poisson's constant
ν_e	mole of elastically effective network chains per cubic centimeter
ρ	density
σ	shear stress
σ_0	yield value
ϕ	packing factor
χ	activity coefficient

Contents