

Applied Pyrolysis Handbook

SECOND EDITION

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EDITED BY
THOMAS P. WAMPLER



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Preface to the Second Edition

Analytical pyrolysis is the study of molecules by applying enough thermal energy to cause bond cleavage, and then analyzing the resulting fragments by gas chromatography, mass spectrometry, or infrared spectroscopy. Pyrolysis has been employed for the analysis of organic molecules for most of this century. It was initially connected with investigations of vapor-phase hydrocarbons and later became a routine technique for analyzing fuel sources and natural and synthetic polymers. Current applications include analysis of trace evidence samples in forensic laboratories, evaluation of new composite formulations, authentication and conservation of artworks, identification of microorganisms, and the study of complex biological and ecological systems. In the time since the first edition of this book, several significant changes have occurred in the field of analytical pyrolysis. First, the introduction of autosamplers for Py-gas chromatography-mass spectrometry (GC/MS) has made the technique more routine, more reproducible, and more acceptable for the analysis of complex solids. Second, the widespread availability of mass spectrometers as detectors for Py-GC has led to a better understanding of the degradation products and the processes that create them. Third, as mass spectrometry detectors have become more sensitive, the application of analytical pyrolysis to trace-level determinations has become routine, so that analysts may not only look at the matrix composition, but also investigate additives such as plasticizers, antioxidants, and stabilizers.

This book is intended to be a practical guide to the application of pyrolysis techniques to various samples and sample types. To that end, general and theoretical considerations, including instrumentation and degradation mechanisms, have been consolidated in the first two chapters. The balance of the book describes the use of pyrolysis as a tool in specific fields. Synthetic polymers, forensic materials, and other samples with a long history of analysis by pyrolysis are covered. In addition, we have been pleased to see some new areas of study, such as the analysis of surfactants, antiquities, and environmental materials, and these topics are presented as well.

The chapters examine the scope of work based on pyrolysis in particular fields of analysis and give specific examples of methods currently used for the examination of representative samples. This book is intended to serve as a starting point for analysts who are adding pyrolysis to their array of analytical techniques by providing concrete examples and suggesting additional reading.

I thank all of the authors for their contributions. With only a few exceptions, the authors of the chapters in the first edition agreed to update the chapters they wrote, adding recent examples and references. Each is actively involved in scientific pursuits, and the time that they have taken away from their busy schedules to contribute to this project was valuable and greatly appreciated.

Thomas P. Wampler

The Editor

Thomas P. Wampler has been actively engaged in the field of analytical pyrolysis for 25 years. He is director of science and technology at CDS Analytical, Inc., in Oxford, Pennsylvania. He is the author or coauthor of numerous professional papers on the use of analytical pyrolysis and other thermal sampling techniques. He received a B.S. degree (1970) in chemistry and a M.Ed. degree (1973) in natural science from the University of Delaware, Newark.

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