



## Modern Drying Technology, Energy Savings (Volume 4)

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The five-volume series provides a comprehensive overview of all important aspects of drying technology like computational tools at different scales (Volume 1), modern experimental and analytical techniques (Volume 2), product quality and formulation (Volume 3), energy savings (Volume 4) and process intensification (Volume 5).

Based on high-level cutting-edge results contributed by internationally recognized experts in the various treated fields, this book series is the ultimate reference in the area of industrial drying. Located at the intersection of the two main approaches in modern chemical engineering, product engineering and process systems engineering, the series aims at bringing theory into practice in order to improve the quality of high-value dried products, save energy, and cut the costs of drying processes.

**Volume 4** deals with the reduction of energy demand in various drying processes and areas, highlighting the following topics: Energy analysis of dryers, efficient solid-liquid separation techniques, osmotic dehydration, heat pump assisted drying, zeolite usage, solar drying, drying and heat treatment for solid wood and other biomass sources, and sludge thermal processing.

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**Volume 1:** Diverse model types for the drying of products and the design of drying processes (short-cut methods, homogenized, pore network, and continuous thermo-mechanical approaches) are treated, along with computational fluid dynamics, population balances, and process systems simulation tools.

Emphasis is put on scale transitions.

#### Volume 2 - Modern Drying Technology: Experimental Techniques

**Volume 2:** Comprises experimental methods used in various industries and in research in order to design and control drying processes, measure moisture and moisture distributions, characterize particulate material and the internal micro-structure of dried products, and investigate the behavior of particle systems in drying equipment. Key topics include acoustic levitation, near-infrared spectral imaging, magnetic resonance imaging, X-ray tomography, and positron emission tracking.

#### Volume 3 - Modern Drying Technology: Product Quality and Formulation

**Volume 3:** Discusses how desired properties of foods, biomaterials, active pharmaceutical ingredients, and fragile aerogels can be preserved during drying, and how spray drying and spray fluidized bed processes can be used for particle formation and formulation. Methods for monitoring product quality, such as process analytical technology, and modeling tools, such as Monte Carlo simulations, discrete particle modeling and neural networks, are presented with real examples from industry and academia.

#### Volume 5 - Process Intensification

**Volume 5:** Dedicated to process intensification by more efficient distribution and flow of the drying medium, foaming, controlled freezing, and the application of superheated steam, infrared radiation, microwaves, power ultrasound and pulsed electric fields. Process efficiency is treated in conjunction with the quality of sensitive products, such as foods, for a variety of hybrid and combined drying processes.

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## **Editorial Review**

### **Review**

“All in all, the book covers a wide range of strategies for energy savings that may be embraced in various drying applications for a broad range of substances. This book covers the state-of-the-art methods and ideas for energy savings in all aspects related to drying technology, from fundamentals to applications. These innovative ideas can be adopted and implemented by engineers and developers who are active in the field of drying technology.” (*Drying Technology*, 1 May 2014)

"This five-volume series provides a comprehensive overview of all important aspects of modern drying technology, concentrating on the transfer of cutting-edge research results to industrial use." (ETDE Energy Database, 2012)

### **About the Author**

Professor Dr. Ing. Evangelos Tsotsas born 1959, Thessaloniki/Greece; PhD: 1985, Karlsruhe/Germany; Habilitation: 1990, Karlsruhe; till 1994: The Dow Chemical Company; since 1994: Professor of Thermal Process Engineering at Otto-von-Guericke-University Magdeburg; 1998-2002: Dean of the Faculty of Process and Systems Engineering; elected German Research Council (DFG) reviewer, member of the selection committee of the Alexander von Humboldt Foundation, the European Multiphase Systems Institute, and the International Center of Heat and Mass Transfer; Chairman of Working Parties on Drying of the EFCE and GVC; 2002: Award for innovation in drying research.

Professor Arun S. Mujumdar; PhD McGill University, Montreal; Professor of Chemical Engineering, McGill University, until July 2000; Visiting Professor at numerous universities; Honorary Professor of five universities in China; President and Principal Consultant, Exergex Corp., Canada 1989-2000; consultant for over 60 companies; authored 2 books and over 60 book chapters, edited or co-edited over 50 books and journals; published more than 300 research papers, presented over 200 conference papers; external reviewer for various research councils; founder, chair or member of organizing panels for numerous major international conferences; elected Fellow of American Society of Mechanical Engineers, Chemical Institute of Canada and Inst. Chem. Eng. (India); member of AIChE, CPPA, Sigma Xi; awarded Senior Fellowship by Japan Society for Promotion of Science (1988 and 1996), Innovation in Drying Award, IDS '86, MIT, The Procter & Gamble Award for Excellence in Drying Research (1998); named Distinguished Scientists of the 20th Century, International Man of the Year by International Biographical Institute, Cambridge (1999); listed in 1000 World Leaders of Influence by the American Biographical Institute, Raleigh, USA (2000).

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