

important to contribute.

It is unfortunate, but true, that many creatively gifted students have never been told they are gifted; they only know that they are different and that their differences are socially unacceptable. It may take nothing more than recognition from a single professor to set them on the path to the productive use of their gifts for the rest of their careers and lives.

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## ChE book reviews

### HEAT AND MASS TRANSFER IN REFRIGERATION AND CRYOGENICS

By J. Bougard and N. Afgan, Editors  
Hemisphere Publishing Corp., 79 Madison Ave., New York, NY 10016; 665 pages, \$165.00 (1987)

Reviewed by  
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This book is a compilation of papers presented at an International Symposium organized by the International Centre for Heat and Mass Transfer in Dubrovnik, Yugoslavia, on September 1 to 5, 1986. The forty-three papers included in this proceedings address three areas of concern to specialists working at low temperatures, namely: thermodynamic and thermophysical properties; heat and mass transfer in refrigeration and at low temperatures; and thermal insulation. As is typical of most meeting proceedings, the quality and the information provided in the papers vary rather widely. A few of the more interesting papers will be noted.

A good review of the thermodynamic analyses that need to be made for refrigeration cycles is presented in one of the plenary papers. After classifying refrigeration cycles into three general types, the author utilizes energy and exergy balances to show the effect of heat and mass transfer irreversibilities in these cycles. He notes that a ratio of exergy loss to heat transfer of 1-3 percent can, with the inefficiencies of compression equipment, result in an energy dissipation that is equivalent to 5-20 percent of the overall heat flux. Guidelines for reducing these losses are suggested.

In the heat and mass transfer area there are a number of good papers providing new experimental studies for pool boiling and film boiling heat transfer. The heat transfer and thermodynamic studies made with a number of less used but more environmentally acceptable refrigerants will be of particular interest to designers looking for alternative refrigerants to the commonly used R11 and R12. Unfortunately, considerable more work must be performed before good choices can be made between these alternative refrigerant mixtures. Another area of heat and mass transfer receiving considerable emphasis was that of freezing soil. One of the papers provides a good experimental and numerical analysis of the coupling of heat and mass transfer in partially saturated frozen soil. The model developed in this study provides a good correla-

tion, provided the hydraulic conductivity of the frozen zone is factored into the model. Another paper details a numerical study using various models to predict the movement of the freezing line in soil around a buried cold gas pipe. These results are compared to a pilot experiment for one type of soil. It is noted that more work will be necessary to verify the models that have been developed. Another interesting paper provides new experimental information on the influence of various transport mechanisms on the total energy flux that is transmitted through a frost layer.

The plenary paper reviewing heat transfer in low-temperature insulation is a good summary of the recent advances in this field. This paper briefly describes the fundamental aspects of heat transfer in low-temperature insulations, examines the anomalous heat transfer effects at cryogenic temperatures and discusses several insulation types which represent state-of-the-art in this field. A good bibliography sup-

ports the review presentation.

Another good study is the one reported on heat transfer in polyurethane foams. In this study the authors experimentally determine the heat flux contributions for each heat transfer mechanism. This permits modeling of the insulation system and optimizing the foam parameters. A paper that complements this last study considers the structural parameters of polyurethane foams and how these affect the thermal conductivity. Taken together, these two papers provide a better understanding of the steps that need to be taken to minimize the thermal conductivity of this widely used insulation material.

Even with a number of excellent papers, the book is over-priced and will only find its way into selected library holdings. Therefore, only a very few readers will have an opportunity to benefit from the dozen or more good papers that were presented at this international meeting. □

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## *In Memoriam . . .*

### *W. Robert Marshall 1916-1988*

W. Robert Marshall died on January 14, 1988. At the time of his death he was Director of the University-Industry Research program. He was born in Calgary, Alberta, on May 19, 1916. He earned his BS degree in chemical engineering in 1938 from Illinois Institute of Technology, and his PhD from the University of Wisconsin in 1941. In 1947 he joined the faculty at the University of Wisconsin, and he served the University in many capacities until his untimely death in January.

Bob became Associate Dean of the College of Engineering in 1953, and was Dean from 1971 to 1981. His interest in new and innovative research and educational programs was critical to many programs that are strong on the campus today. He chaired the committee that led to the establishment of the Department of Nuclear Engineering and the development of the undergraduate curriculum in NE. He was also instrumental in the development of the Solar Energy Laboratory and the Materials Science Program.

Bob was always an enthusiastic supporter of the American Institute of Chemical Engineers. He presented his first paper there in 1939, while a graduate student of Olaf Hougen. He served as a Director for years, was vice president in 1962, president in 1963, and treasurer from 1976 to 1980. He was particularly influential in establishing the Institute's continuing

educational program to make it possible for members of the profession to keep up with new developments in their field.

Bob's accomplishments were recognized in many ways. He was a member of the National Academy of Engineering. He received an honorary doctorate from Illinois Institute of Technology. He was a fellow of the American Academy of Arts and Sciences, and a fellow of the American Institute of Chemical Engineers. He received the Verein Deutscher Ingenieure Gold Medal in 1974. He was an invited speaker at numerous conferences and meetings.

Bob was devoted to bringing the best possible opportunity to the individual. He had great pride in colleagues and students. He was able to convey to staff, students, and colleagues his enthusiasm for their skills and their potential. He gave them opportunities to present their ideas and hopes in a supportive setting. He never assumed any credit for their contributions. His deep concern was for each individual to have the opportunity to realize their hopes and dreams.

Bob is survived by his wife, Dorothy, by three children, and by six grandchildren. He left his colleagues, friends, and family a remarkable legacy of high principles, challenges, and accomplishments on both professional and human levels. □