VOLUME 34 NO. 1

JANUARY 1991

International Journal of EA and MASS TRANSFER

- J. GOSSE, U. GRIGIELE, E. HAHNE, J. P. HARINETE. O. G. MARTYNENKO, W. J. MINKOWYCZ, D. B. SPALDING, E. TANASAWA, C.-L. THEN, R. X. WANG



INTERNATIONAL JOURNAL OF HEAT AND MASS TRANSFER

BOARD OF EDITORS

R. ECHIGO (Associate Editor), Dept. of Mechanical Engineering, Tokyo Institute of Technology. Ohokayama 2-12-1, Meguro-ku, Tokyo 152, Japan

J. GOSSE, C N A.M., 292 rue Saint-Martin, 75141 Paris Cedex 03, France

U. GRIGULL. Technische Universität, Arcisstrasse 21, München, Germany

E. HAHNE (Co-Editor), Institut für Thermodynamik und Wärmetechnik, Pfaffenwaldring 6. D-7000 Stuttgart 80. Germany

J. P. HARTNETT, Energy Resources Center, University of Illinois, Box 4348, Chicago, Illinois 60680, U.S.A.

S. Y. KO (Associate Editor), Institute of Engineering Thermophysics, Chinese Academy of Sciences, PO Box 2706, Beijing 100080, China

O. G. MARTYNENKO, Heat and Mass Transfer Institute, Byelorussian Academy of Sciences, 25 Podlesnaya, Minsk, B.S.S.R., U.S.S.R.

W. J. MINKOWYCZ (Co-Editor), Dept. of Mechanical Engineering, University of Illinois, Box 4348, Chicago, Illinois 60680, U.S.A.

B. R. PAI (Associate Editor), National Aeronautical Laboratory, Post Bag No. 1779, Bangalore 560017, India D. B. SPALDING, Bakery House, 40 High Street, Wimbledon, London SW19 5AU, U.K.

I. TANASAWA, Institute of Industrial Science, University of Tokyo, 7-22-1 Roppongi, Minato-ku, Tokyo 106, Japan

C.-L. TIEN, University of California, Irvine, California 92717, U.S.A.

B. X. WANG, Thermal Engineering Dept., Tsinghua University, Beijing 100084, China

HONORARY EDITORIAL ADVISORY BOARD

Chairman: E. R. G. ECKERT, University of Minnesota, Minneapolis, Minnesota 55455, U.S.A. Past-Chairman: OWEN SAUNDERS, F.R.S., Imperial College, London, U.K.

Founding Editor: C. GAZLEY, Jr., The RAND Corporation. Santa Monica, California 90406. U.S.A.

F. J. BAYLEY, Sussex
A. E. BERGLES, Troy
F. BOSNJAKOVIC, Stuttgart
B. T. CHAO, Urbana
J. A. CLARK, Ann Arbor
M. COMBARNOUS, Bordeaux
I. CURIEVICI, Iasi
D. A. DE VRIES, Helmond
J. J. D. DOMINGOS, Lisbon
R. V. DUNKLE, Melbourne
D. K. EDWARDS, Irvine
Y. FUJITA, Fukuoka
B. GEBHART, Philadelphia
O. A. GERASHCHENKO, Kiev
R. J. GOLDSTEIN, Minneapolis
P. GRASSMAN, Zurich
A. A. GUKHMAN, Moscow
W. B. HALL, Manchester
G. F. HEWITT, London
T. W. HOFFMANN, Hamilton

T. F. IRVINE, Jr., Stony Brook S. KAKAC, Miami KATTO, Tokyo W. M. KAYS, Stanford A. I. LEONTIEV, Moscow J. MATHIEU, Ecully F. MAYINGER, Munich M. D. MIKHAILOV, Sofia Yu. A. MIKHAILOV, Riga Y. MORI, Tokyo I. L. MOSTINSKY, Moscow L. G. NAPOLITANO, Naples R. I. NIGMATULIN, Moscow F. OGINO, Kyoto T. D. PATTEN, Edinburgh J. R. A. PEARSON, London G. D. RAITHBY, Waterloo A. RAMACHANDRAN, Nairobi J. F. RICHARDSON, Swansea W. M. ROHSENOW, Cambridge, Mass. J. J. RONCO, La Plata
R. H. SABERSKY, Pasadena
J. SCHNELLER, Bechovice
R. A. SEBAN, Berkeley
R. SEMERIA, Grenoble
R. K. SHAH, Lockport
S. SIDEMAN, Haifa
R. S. SILVER, Glasgow
M. SILVESTRI, Milan
H. SIMPSON, Glasgow
E. M. SPARROW, Minneapolis
K. STEPHAN, Stuttgart
M. A. STYRIKOVICH, Moscow
K. SUZUKI, Kyoto
M. G. VELARDE, Madrid
R. VISKANTA, West Lafayette
D. VORTMEYER, Munich
J. W. WESTWATER, Urbana
S. M. YANG, Shanghai
A. A. ZHUKAUSKAS, Vilnius

Subscription Rates 1991

Annual institutional subscription rate (1991) DM 2200.00. Two-year institutional rate (1991/92) DM 4180.00. Personal subscription rate for those whose library subscribes is available on request. Subscription rates for Japan include despatch by air and prices are available on application. Prices are subject to change without notice. Subscription enquiries from customers in North America should be sent to: Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, New York 10523, U.S.A., and for the remainder of the world to: Pergamon Press plc, Headington Hill Hall, Oxford OX3 0BW, U.K.

Back Issues. Back issues of all previously published volumes are available direct from Pergamon Press offices.

Published monthly

Copyright (*) Pergamon Press plc 1991

It is a condition of publication that manuscripts submitted to this journal have not been published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the publisher if and when the article is accepted for publication. However, assignment of copyright is not required from authors who work for organizations which do not permit such assignment. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature, and translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical, photocopying, recording or otherwise, without permission in writing from the copyright holder.

Photocopying Information for Users in the U.S.A. The Item-Fee Code for this publication indicates that authorization to photocopy items for internal or personal use is granted by the copyright holder for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service provided the stated fee for copying, beyond that permitted by Section 107 or 108 of the United States Copyright Law, is paid. The appropriate remittance of \$3.00 per copy per article is paid directly to the Copyright Clearance Center Inc., 27 Congress Street, Salem. MA 01970.

Permission for other use. The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific written permission must be obtained from the publisher for such copying.

The Item-Fee Code for this publication is: 0017-9310/91 \$3.00+0.00

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

Disclaimer. Whilst every effort is made by the publishers and editorial board to see that no inaccurate or misleading data, opinion or statement appear in this journal, they wish to make it clear that the data and opinions appearing in the articles and advertisements herein are the sole responsibility of the contributor or advertiser concerned. Accordingly, the publishers, the editorial board and editors and their respective employees, officers and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement.