

# CHEMICAL ENGINEERING JOURNAL

## An International Journal of Research and Development

### Co-Editors:

Environmental Chemical Engineering:

**Professor Laurence Weatherley**, University of Kansas, Dept. of Chemical and Petroleum Engineering, 4132 Learned Hall, 1530 W. 15th Street, Lawrence, KS 66045-7609, USA

**Professor Marc Deshusses**, Dept. of Civil and Environmental Engineering, Duke University, 127 Hudson Hall, Box 90287, Durham, NC 27708-0287, USA

Chemical Reaction Engineering:

**Professor Guy B. Marin**, Universiteit Gent, Chemical Engineering Department, Laboratory for Chemical Technology, Krijgslaan 281 S5, B-9000 Gent, Belgium

**Professor King L. Yeung**, Hong Kong University of Science and Technology, Department of Chemical and Biomolecular Engineering, Clear Water Bay, Kowloon, Hong Kong

Materials Synthesis and Processing:

**Professor Jesus Santamaria**, University of Zaragoza, Dept. of Chemical and Environmental Engineering, 50009 Zaragoza, Spain

### Editorial Board:

**Prof. B. Andersson**, Department of Chemical Reaction Engineering, Göteborg, Sweden

**Prof. J.M. Asua**, Universidad del Pais Vasco, San Sebastian, Spain

**Prof. M.A. Baltanas**, Titular DE(UNL), Santa Fe, Argentina

**Prof. C. de Bellefon**, Director of the Laboratory for Catalytic Process Engineering, Villeurbanne, France

**Dr. R. Brødesen**, SINTEF Materials Technology, Oslo, Norway

**Prof. L.J. Broadbelt**, Northwestern University, Evanston, IL, USA

**Prof. D.P.Y. Chang**, University of California Davis, Davis, CA, USA

**Prof. N.T.S. Chung**, National University of Singapore, Singapore

**Dr. M. Fan**, Georgia Institute of Technology, Atlanta, GA, USA

**Prof. P. Forzatti**, Politecnico di Milano, Milano, Italy

**Prof. V. Hessel**, IMM Institut für Mikrotechnik Mainz GmbH, Mainz, Germany

**Prof. S. Jenekhe**, Seattle, WA, USA

**Prof. T. Randall Lee**, University of Houston, Houston, TX, USA

**Dr. G. Luo**, Tsinghua University, Beijing, China

**Prof. G. McKay**, Hong Kong University of Science and Technology, Hong Kong, China

**Prof. M. Menéndez**, University of Zaragoza, Zaragoza, Spain

**Prof. A. Monzón**, University of Zaragoza, Zaragoza, Spain

**Prof. I.S. Nam**, Pohang University of Science & Technology, Kyungbuk, Korea

**Prof. E.B. Nauman**, Rensselaer Polytechnic Institute, Troy, NY, USA

**Prof. B.C. Pan**, Nanjing University, Nanjing, China

**Prof. J. Petera**, Technical University of Lodz, Lodz, Poland

**Prof. A.E. Rodrigues**, Univ. of Porto, Porto, Portugal

**Prof. A. Seidel-Morgenstern**, Max-Planck-Institut fuer Dynamik

Komplexer Technischer Systeme, Magdeburg, Germany

**Prof. G. Stevens**, Univ. of Melbourne, Melbourne, Australia

**Prof. C. Tsouris**, Oak Ridge National Laboratory, Oak Ridge, TN, USA

**Dr. G. Walker**, The Queens University of Belfast, Northern Ireland, UK

**Prof. R.A. Williams**, University of Leeds, UK

**Prof. G. de With**, Eindhoven University of Technology, Eindhoven, Netherlands

**Prof. C.S. Wu**, National Taiwan University, Taipei, Taiwan

**Prof. X. Zhang**, Dalian University of Technology, Dalian, China

### Aims and Scope

The *Chemical Engineering Journal* provides an international forum for the presentation of original research, interpretative reviews and discussion of new development in chemical engineering. Papers which describe novel theory and its application to practice are welcome, as are those which illustrate the transfer of techniques from other disciplines. Reports of carefully executed experimental work, which is soundly interpreted are also welcome.

Within the Chemical Engineering Journal, the *Environmental Chemical Engineering* section presents papers dealing with topics in environmental chemical and process engineering. Treatment processes, environmental process control and measurement and clean process technology are covered, and papers in which knowledge from other disciplines is integrated with chemical engineering are especially welcome.

Within the Chemical Engineering Journal, the *Chemical Reaction Engineering* section presents papers on a wide range of topics including reaction kinetics, applied catalysis, simulation and optimization of different types of reactors, unsteady-state reactors, multiphase reactors, and fundamental investigations of the processes of heat, mass and momentum transfer that take place along with chemical reaction. Research works addressing critical areas of reactor engineering (e.g. reactor materials, control strategies, reactor safety and environmental issues), and emerging reactor technologies (e.g. membrane reactors, chromatographic reactors, unconventional fluidized beds, electrochemical reactors, micro-reactors, etc.) are particularly welcome.

Within the Chemical Engineering Journal, the *Materials Synthesis and Processing* section presents papers dealing with different aspects of the preparation and characterization of advanced materials. Novel physical and chemical methods of synthesis will be covered, as well as the processes used to obtain materials of different morphologies (particles, films, fibers), and to modify their surface and structural properties, always from a chemical engineering point of view. Manuscripts dealing with micro- and nano-structured materials, and those describing the preparation of composite and hybrid materials with advanced properties are especially welcome.

**Publication information:** *Chemical Engineering Journal* (ISSN 1385-8947). For 2009, volume(s) 145–154 (30 issues) are scheduled for publication. Subscription prices are available upon request from the Publisher or from the Elsevier Customer Service Department nearest you or from this journal's website (<http://www.elsevier.com/locate/cej>). Further information is available on this journal and other Elsevier products through Elsevier's website: (<http://www.elsevier.com>). Subscriptions are accepted on a prepaid basis only and are entered on a calendar year basis. Issues are sent by standard mail (surface within Europe, air delivery outside Europe). Priority rates are available upon request. Claims for missing issues should be made within six months of the date of dispatch.

**USA mailing notice:** – *Chemical Engineering Journal* (ISSN 1385–8947) is published semi-monthly with the exception of March June and September by Elsevier B.V. (Radarweg 29, 1043 NX Amsterdam, The Netherlands). Periodical postage paid at Rahway NJ and additional mailing offices.

USA POSTMASTER: Send change of address: *Chemical Engineering Journal*, Elsevier, Customer Service Department, 11830 Westline Industrial Drive, St. Louis, MO 63146, USA.

AIRFREIGHT AND MAILING IN USA by Mercury International Limited, 365, Blair Road, Avenel, NJ 07001.

**Orders, claims, and journal enquiries:** please contact the Elsevier Customer Service Department nearest you:

**St. Louis:** Elsevier, Customer Service Department, 11830 Westline Industrial Drive, St. Louis, MO 63146, USA; phone: (877) 8397126 [toll free within the USA]; (+1) (314) 4537076 [outside the USA]; fax: (+1) (314) 5235153; e-mail: [JournalCustomerService-usa@elsevier.com](mailto:JournalCustomerService-usa@elsevier.com)

**Oxford:** Elsevier Customer Service Department, The Boulevard, Langford Lane, Kidlington OX5 1GB, UK; phone: (+44) (1865) 843434; fax: (+44) (1865) 843970; e-mail: [JournalsCustomerServiceEMEA@elsevier.com](mailto:JournalsCustomerServiceEMEA@elsevier.com)

**Tokyo:** Elsevier, Customer Service Department, 4F Higashi-Azabu, 1-Chome Bldg, 1-9-15 Higashi-Azabu, Minato-ku, Tokyo 106-0044, Japan; phone: (+81) (3) 5561 5037; fax: (+81) (3) 5561 5047; e-mail: [JournalsCustomerServiceJapan@elsevier.com](mailto:JournalsCustomerServiceJapan@elsevier.com)

**Singapore:** Elsevier, Customer Service Department, 3 Killiney Road, #08-01 Winsland House I, Singapore 239519; phone: (+65) 63490222; fax: (+65) 67331510; e-mail: [JournalsCustomerServiceAPAC@elsevier.com](mailto:JournalsCustomerServiceAPAC@elsevier.com)

### Advertising Information

Advertising orders and enquiries can be sent to: Janine Castle, Elsevier Ltd., The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK; phone: (+44) 1865 843 844; fax: (+44) 1865 853 973; e-mail: [j.castle@elsevier.com](mailto:j.castle@elsevier.com). Customers in the US and Canada can also contact: Mr Tino DeCarlo, Advertising Department, Elsevier Inc., 360 Park Avenue South, New York, NY 10010-1710, USA; phone: (+1) (212) 633 3815; fax: (+1) (212) 633 3820; e-mail: [t.decarlo@elsevier.com](mailto:t.decarlo@elsevier.com).

### Funding body agreements and policies

Elsevier has established agreements and developed policies to allow authors whose articles appear in journals published by Elsevier, to comply with potential manuscript archiving requirements as specified as conditions of their grant awards. To learn more about existing agreements and policies please visit <http://www.elsevier.com/fundingbodies>

⊗ The paper used in this publications meets the requirements of ANSI/ NISOZ39.48-1992 (Permanence of Paper) .

Printed in the Netherlands