



Modern Materials and Technologies for
Civil and Road Engineering

Modern Materials and Technologies for Civil and Road Engineering

Dr. Ramadhansyah Putra Jaya

Edited by
Dr. Ramadhansyah Putra Jaya



978-3-0357-1830-0
Key Engineering Materials Vol. 879
Electronically available at www.scientific.net



TTP TRANS TECH PUBLICATIONS

Key Engineering Materials

ISSN 1013-9826

Founding Editor:

Fred H. Wöhlbier

Honorary Editor:

Prof. Erian A. Armanios, University of Texas at Arlington, Mechanical and Aerospace Engineering;
500 W. First Street, Woolf Hall 211, Box 19018, Arlington, USA, 76019-0018;

Editor in Chief

Prof. Dr. José Manuel Torralba, Universidad Carlos III de Madrid, IMDEA Materials; Av. Universidad 30,
Leganés, 28911, Spain;

Editorial Board: see back inside cover.

Aims and Scope:

"Key Engineering Materials" is a peer-reviewed periodical which covers entire range of basic and applied aspects of the synthesis and research, modelling, processing and application of advanced engineering materials. "Key Engineering Materials" is one of the largest periodicals in its field.

"Key Engineering Materials" specializes in the publication of thematically complete volumes from international conference proceedings and complete special topic volumes. We do not publish stand-alone papers by individual authors.

Abstracted/Indexed in:

SCOPUS www.scopus.com.

REAXYS www.reaxys.com.

Ei Compendex www.ei.org/.

SCImago Journal & Country Rank (SJR) www.scimagojr.com.

Inspec (IET, Institution of Engineering Technology) www.theiet.org.

Chemical Abstracts Service (CAS) www.cas.org.

Google Scholar scholar.google.com.

GeoRef www.americangeosciences.org/georef.

INIS Atomindex (International Nuclear Information System) <https://inis.iaea.org>.

Cambridge Scientific Abstracts (CSA) www.csa.com.

ProQuest www.proquest.com.

Ulrichsweb www.proquest.com/products-services/Ulrichsweb.html.

EBSCOhost Research Databases www.ebscohost.com/.

CiteSeerX citeseerx.ist.psu.edu.

Zetoc zetoc.jisc.ac.uk.

EVISA <http://www.speciation.net/Public/Linklists/EVISA.html>.

Index Copernicus Journals Master List www.indexcopernicus.com.

WorldCat (OCLC) www.worldcat.org.


Scientific.Net
Publisher in Materials Science & Engineering

Trans Tech Publications Ltd
Kapellweg 8 • CH-8806 Baech • Switzerland
Fax +41 (44) 922 10 33 • e-mail: office@scientific.net
<http://www.scientific.net>

Key Engineering Materials

ISSN 1013-9826

Editorial Board:

Prof. Aldo Roberto Boccaccini

University of Erlangen-Nürnberg, Institute of Biomaterials, Department of Materials Science and Engineering; Cauerstrasse 6, Erlangen, 91058, Germany;

Dr. Li Chang

University of Sydney, School of Aerospace, Mechanical and Mechatronic Engineering; Sydney, Australia, 2006;

Prof. Yi Bing Cheng

Monash University, Department of Materials Science and Engineering; PO Box 197, Caulfield East, Australia, 3145;

Prof. Robert Danzer

Montanuniversität Leoben, Institut für Struktur- und Funktionskeramik; Peter-Tunner-Strasse 5, Leoben, A-8700, Austria;

Prof. Suong Van Hoa

Concordia University, Department of Mechanical and Industrial Engineering; 1455 Demaisonneuve West # EV 4-145, Montreal, Canada, H3G1M8;

Prof. Xiao Zhi Hu

University of Western Australia, School of Mechanical and Chemical Engineering; Perth, Australia, WA 6009;

Prof. Shankar Mall

Air Force Institute of Technology, Department of Aeronautics and Astronautics; 2950, Hobson Way, AFIT/ENY, Wright-Patterson AFB, USA, 45433-7765;

Prof. Mohamed A. Taha

Ain-Shms University, Department of Design and Production Engineering, Faculty of Engineering; Khalifa El-Maamon st, Abbasiya sq., Cairo, Egypt, 11566;

Prof. Alejandro Ureña Fernandez

Universidad Rey Juan Carlos (URJC), Department of Materials Science and Engineering; Tulipan s/n 28933, Mostoles, Madrid, Spain;

Prof. Dragan P. Uskokovic

Institute of Technical Sciences of the Serbian Academy of Sciences and Arts; Knez Mihailova 35/IV, Belgrade, Serbia;

Prof. Zhi Rui Wang

University of Toronto, Department of Materials Science and Engineering; 184 College Street, Toronto, Canada, M5S 3E4;

Prof. Ming Xing Zhang

University of Queensland, School of Mechanical and Mining Engineering; St. Lucia, Queensland, Australia, QLD 4072;

Also published in these series:

878 (2021) Advanced Materials Science and Technologies

877 (2021) Material and Manufacturing Technology XI

876 (2021) Material Engineering and Application III

875 (2021) Advanced Materials - XVI

874 (2021) Frontiers in Molecular Sciences

873 (2021) Material Engineering Research II


Scientific.Net
Publisher in Materials Science & Engineering

Trans Tech Publications Ltd
Kapellweg 8 • CH-8806 Baech • Switzerland
Fax +41 (44) 922 10 33 • e-mail: office@scientific.net
<http://www.scientific.net>

Modern Materials and Technologies for Civil and Road Engineering

Edited by
Dr. Ramadhansyah Putra Jaya

Modern Materials and Technologies for Civil and Road Engineering

Selected, peer-reviewed papers from the
4th National Conference on
Wind and Earthquake Engineering (4th NCWE),
October 16-17, 2020, Gombang, Malaysia

Edited by

Dr. Ramadhansyah Putra Jaya

Copyright © 2021 Trans Tech Publications Ltd, Switzerland

All rights reserved. No part of the contents of this publication may be reproduced or transmitted in any form or by any means without the written permission of the publisher.

Trans Tech Publications Ltd
Kapellweg 8
CH-8806 Baech
Switzerland
<http://www.scientific.net>

Volume 879 of
Key Engineering Materials
ISSN print 1013-9826
ISSN cd 1662-9809
ISSN web 1662-9795

Full text available online at <http://www.scientific.net>

Distributed worldwide by
Trans Tech Publications Ltd
Kapellweg 8
CH-8806 Baech
Switzerland
Phone: +41 (44) 922 10 22
Fax: +41 (44) 922 10 33
e-mail: sales@scientific.net