

MRS MATERIALS RESEARCH SOCIETY® Advancing materials. Improving the quality of life.

CAMBRIDGE UNIVERSITY PRESS

# Journal of MATERIALS RESEARCH

JOURNAL OF MATERIALS RESEARCH (JMR) is an interdisciplinary journal serving the materials research community through publication of original research articles and invited reviews encompassing the synthesis, processing, characterization, properties, and theoretical description of materials.

**JMR** publishes advances in new materials and novel functionalities and development of performance improvements relative to state of the art. Engineering studies and applications to commercial products are beyond the scope of **JMR** and should be submitted elsewhere. Manuscripts that report data without giving an analysis, interpretation, or discussion are only acceptable if the data are sufficiently important that publication is expected to lead to significant new studies or advancements in science or technology.

Manuscripts must be submitted to the Journal of Materials Research electronically via ScholarOne manuscripts, at the following website address: http://mc.manuscriptcentral.com/jmr. Electronic submission expedites the review process and also allows authors to track the status of their manuscripts at any time. Complete instructions are available on the ScholarOne site and authors will be prompted to provide all necessary information.

Manuscripts must be prepared in English, using a word processing program, formatted to fit  $8\frac{1}{2}$  x11 in. paper, and saved as .doc or .pdf files. Separate graphics files (.eps and .tif) must be uploaded for each figure. Authors may also upload .xls or .ppt supplemental files as part of the manuscript submission process. All of these files will be converted to .pdf format. Detailed instructions are available on the submission web site. During submission, authors must enter all coauthor names and e-mail addresses. Manuscripts will not be considered for peer review until this information is provided. Authors must also enter manuscript keywords using the JMR keyword list (located on the submission web site). Authors who are not fluent in English must have their manuscript edited for correct English grammar and sentence structure before submission.

Authors are expected to follow the conventional writing, notation, and illustration style prescribed in *Scientific Style and Format: the CSE Manual for Authors, Editors and Publishers, 7th edition, 2006.* Authors should also study the form and style of printed material in this journal. SI units should be used. Authors should use an identical format for their names in all publications to facilitate use of citations and author indexes.

Manuscripts are accepted with the understanding that they represent original research, except for review articles, and that they have not been copyrighted, published, or submitted for publication elsewhere. Authors submitting manuscripts to *JMR* who have related material under consideration or in press elsewhere should send a copy of the related material to *JMR* at the time of submission. While their manuscripts are under consideration at *JMR*, authors must disclose any such related material. To expedite the review process, authors may provide names and contact information for up to four possible reviewers.

Articles are original research reports that include complete, detailed, self-contained descriptions of research efforts. All articles must contain an abstract and section headings.

Commentaries and Reviews: Journal of Materials Research occasionally publishes commentaries on topics of current interest or reviews of the literature in a given area. If an author proposes a review, the title, abstract, and a brief outline should be submitted to the Editorial Office via e-mail for prior consultation on the appropriateness of the topic.

Color policy: It is not necessary for authors to indicate that a figure should be displayed in color online. JMR will assume that any author who submits figures in color wants and agrees to their being produced in color online. Figures may be printed in color at the author's request for an additional charge. Color figures must be submitted before the paper is accepted for publication, and cannot be received later in the process. Authors cannot submit two versions of the same figure, one for color and one for black and white; only one version can be submitted. Authors need to carefully consider the following when submitting figures in color that will

be published in color online only: 1) The colors chosen must reproduce effectively and the colors should be distinguishable when printed in black and white; 2) The descriptions of figures in text and captions must be suffi ciently clear for both online and print copy. When submitting figures to be in color online only, authors should include the phrase <<color online>> in the figure captions. This is the author's responsibility. Authors will see these color figures when viewing their author page proofs on screen. Authors should always print their page proofs in black and white to see how they will appear in print. Authors will NOT be allowed to submit color figures to replace black and white figures in the page proof stage. To maximize the probability that figures will be published in color online and also print as good quality black and white or grayscale graphics, authors are encouraged to follow these figure submission guidelines: 1) Submit a color graphic in Tagged Image File Format (.tif); 2) Submit color graphics with a resolution of at least 300 dpi (600 dpi if there is text or line art in the figure); 3) Submit color graphics in CMYK format; 4) Submit figures sized to fit the actual column or page width of the journal so that reduction or enlargement is not necessary; 5) Submit multipart figures in one single electronic file.

Copyright © 2020, Materials Research Society. All rights reserved. No part of this publication may be reproduced, in any form or by any means, electronic, photocopying, or otherwise, without permission in writing from Cambridge University Press. Policies, request forms and contacts are available at: http://www.cambridge.org/rights/permissions/permission. htm. Permission to copy (for users in the USA) is available from Copyright Clearance Center at: http://www.copyright.com, email: info@copyright.com.

Journal of Materials Research Subscription Prices (2020) [includes on-line web access]					
	USA and Poss.	Non-USA	Online Only		
MRS Regular and Student Members	\$260.00	\$369.00	-		
Institutions	\$2378.00	\$2313.00	\$2146.00		

Journal of Materials Research (ISSN: 0884-2914) is published twenty-four times a year by Cambridge University Press, One Liberty Plaza, 20th Floor, New York, NY 10006 for the Materials Research Society. Periodical Postage Paid in New York, NY and additional mailing offices POSTMASTER: Send address changes to Journal of Materials Research, c/o Journals Dept., Cambridge University Press, One Liberty Plaza, 20th Floor, New York, NY 10006, USA.

Subscriptions, renewals, address changes, and single-copy orders should be addressed to Subscription Fulfillment, *Journal of Materials Research*, Cambridge University Press, One Liberty Plaza, 20th Floor, New York, NY 10006, USA (for USA, Canada, and Mexico); or Cambridge University Press, University Printing House, Shaftesbury Road, Cambridge, CB28BS, England (for UK and elsewhere). Allow at least six weeks advance notice. For address changes, please send both old and new addresses and, if possible, include a mailing label from a recent issue. Requests from subscribers for missing journal issues will be honored without charge only if received within six months of the issue's actual date of publication; otherwise, the issue may be purchased at the single-copy price.

**Reprints** of individual articles in *Journal of Materials Research* may be ordered. For information on reprints, please contact Cambridge University Press. Reprints of complete back issues older than the prior volume year may be ordered on an individual basis via Cambridge Core. To determine availability, visit the appropriate page for the *JMR* back issue desired (cambridge.org/jmr).

Individual member subscriptions are for personal use only.



Editor-in-Chief: Gary L. Messing, Ceramic materials, The Pennsylvania State University, USA

Associate Editor: Susmita Bose, Biomaterials, Washington State University, USA

Associate Editor: Mathias Göken, Advanced metallic materials, Friedrich-Alexander-University Erlangen-Nürnberg, Germany

Associate Editor: Sarah E. Morgan, Polymeric materials, The University of Southern Mississippi, USA

#### 2020 Principal Editors:

Kantesh Balani, Biomaterials, high temperature ceramics Indian Institute of Technology, Kanpur

Amit Bandyopadhyay, Hard biomaterials, Additive manufacturing, Washington State University, USA

Ricardo H.R. Castro, Interfaces thermodynamics, Calorimetry, Ceramics, University of California, Davis, USA

Jinju Chen, Soft materials/thin films, Nanoindentation, Newcastle University, United Kingdom

Xiaobo Chen, Photocatalysis and batteries, University of Missouri-Kansas City, USA

Sung-Yoon Chung, Energy, Electron microscopy, Interface science, KAIST. Korea

Sylvain Deville, Ceramic materials, Processing, Bioinspired materials,

Franz Faupel, Functional nanomaterials, VPD, Metallic glasses, University of Kiel, Germany

Michael C. Gao, High entropy alloys, Computational materials science, National Energy Technology Laboratory/AECOM, USA

Erik G. Herbert, Nanoindentation, Small-scale mechanical behavior Michigan Technological University, USA

Jon Ihlefeld, Ferroelectrics, Thin films, Ionic conductors, University of Virginia, USA

Quanxi Jia, Superconductors, Ferroelectric/magnetic materials, Thin films University of Buffalo, USA

C. Robert Kao, Metallic materials, Diffusion and joining, National Taiwan University, Taiwan

Edson Roberto Leite, Materials chemistry, Nanocrystals, Synthesis, Brazilian Nanotechnology National Laboratory, Brazil

Lei Liu, Semiconductors, Electronic structure, Spectroscopy, Changchun Institute of Optics, Fine Mechanics and Physics, China

Michele Manuel, Phase transformations, Materials design, University of Florida. USA

Michael E. McHenry, Magnetic materials, Carnegie Mellon University, USA

Scott T. Misture, In-situ diffraction, Electrochemically active ceramics, Alfred University, USA

Lakshmi S. Nair, Biomaterials, Tissue regeneration, Drug delivery, University of Connecticut, USA

Takahito Ohmura, Nanomechanical characterization, Lattice defects, National Institute for Materials Science, Japan

George M. Pharr, Mechanical behavior, Nanoindentation, Texas A&M University, USA

Joshua A. Robinson, 2D material synthesis and properties, The Pennsylvania State University, USA

Fabrice Rossignol, Ceramic processes, Additive manufacturing CNRS, France

Don W. Shaw, Epitaxy, Vapor deposition, Semiconductors, The University of Texas at Dallas, USA

Ralph Spolenak, Size effects in materials, Micro 3D printing, ETH Zurich, Switzerland

Ziqi Sun, Energy nanomaterials, Wet chemical synthesis, Queensland University of Technology, Australia

Peng Tao, Solar/thermal energy materials, polymer composites Shanghai Jiao Tong University, China

Venu G. Varanasi, Amorphous materials, biomimetics, bioprinting University of Texas at Arlington, USA

Chongmin Wang, Energy storage, Microscopy, In-situ/operando technique, Pacific Northwest National Laboratory, USA

Xingcheng Xiao, Energy storage materials, AFM, Nanoindentation, General Motors, USA

Sam Zhang, Thin films/coatings, Nanyang Technological University, Singapore

Yanchun Zhou, Structural ceramics, Electronic structure, Aerospace Research Institute of Materials and Processing Technology, China

**Editorial Office:** Ellen W. Kracht, *Publications Manager, Materials Research Society, Warrendale, PA*Leslie Truver, *JMR Editorial Assistant, Materials Research Society, Warrendale, PA*Kirby L. Morris, *Editorial and Production Associate, Materials Research Society, Warrendale, PA*Eileen M. Kiley, *Director of Communications, Materials Research Society, Warrendale, PA* 

Cover: Ni/rGO/EP composite foam. Z. Wang, Q. Yu, W. Nie, P. Chen: Preparation and microwave absorption properties of Ni/rGO/EP composite foam. p. 2107



## Volume 35, Number 16, August 28, 2020

### **ENERGY CONVERSION AND STORAGE MATERIALS**

### **INVITED PAPER**

2077–2086	Phonons correction of the energy and photoionization cross section in polar semiconductors and hollow nanoparticles	Safae M'zerd, Abdelali Talbi, Mouad Bikerouin, Mohamed El Haouari, Noreddine Aghoutane, Mohamed El-Yadri, Zhi-Hai Zhang, Jian-Hui Yuan, Mostafa Sadoqi, Gen Long, El Mustapha Feddi
ARTICLES		
2087–2097	Complications of using thin film geometries for nanocrystalline thermal stability investigations	Xuyang Zhou, Tyler Kaub, Florian Vogel, Gregory B. Thompson
2098–2105	Assessing atomically thin delta-doping of silicon using mid-infrared ellipsometry	Aaron M. Katzenmeyer, Ting S. Luk, Ezra Bussmann, Steve Young, Evan M. Anderson, Michael T. Marshall, James A. Ohlhausen, Paul Kotula, Ping Lu, DeAnna M. Campbell, Tzu-Ming Lu, Peter Q. Liu, Daniel R. Ward, Shashank Misra
2106–2114	Preparation and microwave absorption properties of Ni/rGO/EP composite foam	Zixuan Wang, Qi Yu, Weicheng Nie, Ping Chen
2115–2125	Copper- and nickel-based flexible polyester electrodes for energy storage devices	Abdulcabbar Yavuz
2126–2137	Fabrication and characteristics of solar-driven phase change microcapsules with crystalline ${\rm TiO_2/CuS}$ hybrid shell for solar energy conversion and storage	Xiaoyue Fan, Xiaolin Qiu, Lixin Lu, Binglin Zhou
2138–2147	Template-assisted synthesis of porous ${\rm TiO_2}$ photoanode for efficient dye-sensitized solar cells	Chunmei Lv, Xiuwen Wang, Qun Li, Chunyan Li, Qiuyun Ouyang, Yongjun Liu, Lihong Qi
2148–2157	$g\text{-}C_3N_4$ nanoparticle@porous $g\text{-}C_3N_4$ composite photocatalytic materials with significantly enhanced photo-generated carrier separation efficiency	Qianhong Shen, Chengyan Wu, Zengyu You, Feilong Huang, Jiansong Sheng, Fang Zhang, Di Cheng, Hui Yang
2158–2165	Electron transport enhancement in perovskite solar cell $\emph{via}$ the polarized ${\sf BaTiO_3}$ thin film	Xinshu Luo, Jie Ding, Jinfeng Wang, Jingbo Zhang
REVIEWS		
2166–2189	Interface passivation strategy improves the efficiency and stability of organic-inorganic hybrid metal halide perovskite solar cells	Zhaoyi Wan

, Press
ē
versity
Ę
$\supset$
ridae
qu
Ö
۵
ne
on
ed
S
blis
Publis
31 Publish
.231 Publis
120.231 Publist
.2020.231 Publish
nr.2020.231 Publisl
/imr.2020.231
/imr.2020.231
.1557/imr.2020.231 Publis
/imr.2020.231

2190–2207	Catalysis using metal–organic framework-derived nanocarbons: Recent trends	Oxana V. Kharissova, Boris I. Kharisov, Igor Efimovich Ulyand, Tomas Hernandez García
ARTICLES		
2208–2217	Synthesis of $\mathrm{SnO}_2$ nanoparticles for formaldehyde detection with high sensitivity and good selectivity	Liping Gao, Hao Fu, Jiejun Zhu, Junhai Wang, Yuping Chen, Hongjie Liu
2218–2229	Selective catalytic reduction of ${\rm NO}_x$ with ${\rm NH_3}$ over cerium-tungstentitanium mixed oxide catalyst: Synergistic promotional effect of ${\rm H_2O_2}$ and ${\rm Ce}^{4+}$	Zhi-bo Xiong, Xiao-ke Qu, Yan-ping Du, Cheng-xu Li, Jing Liu, Wei Lu, Shui-mu Wu
2230–2238	The thermophysical properties and defect chemistry of HfO <sub>2</sub> –Sm <sub>3</sub> TaO <sub>7</sub> ceramics	Ying Zhou, Guoyou Gan, Zhenhua Ge, Jing Feng, Peng Song
2239–2246	Development of high-temperature oxide melt solution calorimetry for $p$ -block element containing materials	Mykola Abramchuk, Kristina Lilova, Tamilarasan Subramani, Ray Yoo, Alexandra Navrotsky