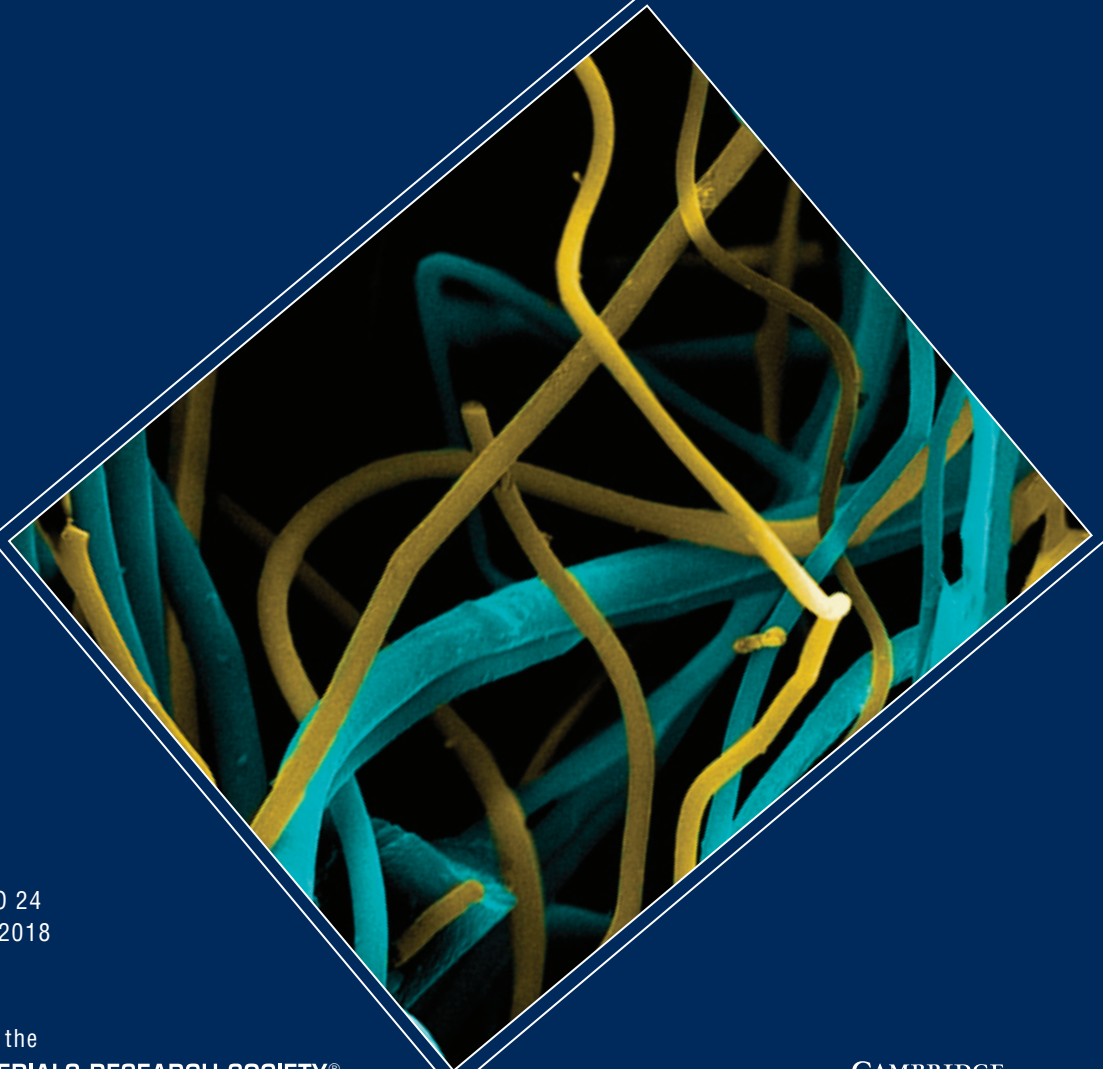




jmr Journal of
MATERIALS RESEARCH



VOLUME 33 • NO 24
DECEMBER 28, 2018

A publication of the

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 new research that demonstrates a significant impact or advance of scientific understanding of interest to the materials research community. 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 8½ 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 sufficiently 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 © 2018, 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 (2018)

[includes on-line web access]

	USA and Poss.	Non-US	Online Only
MRS Regular and Student Members	\$287.00	\$351.00	\$110.00
Institutions	\$2218.00	\$2156.00	\$1946.00

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, CB2 8BS, 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.

Journal of MATERIALS RESEARCH

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

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

Associate Editor: Jürgen Eckert, *Metallic materials, Montanuniversität Leoben, Austria*

Associate Editor: Linda S. Schadler, *Polymeric materials, University of Vermont, USA*

2018 Principal Editors:

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*

Yang-T. Cheng, *Mechanical behavior, Electrochemical energy storage, University of Kentucky, USA*

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

Paolo Colombo, *Pre ceramic polymers, Porous ceramics, University of Padova, Italy; The Pennsylvania State University, USA*

Sylvain Deville, *Ceramic materials, Processing, Bioinspired materials, CNRS, France*

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*

Mathias Göken, *Superalloys, Nanomaterials, Nanomechanics, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*

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*

Jörg Löffler, *Metallic materials/synthesis and properties, ETH Zurich, Switzerland*

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

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

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

Sarah E. Morgan, *Polymer surfaces and interfaces, The University of Southern Mississippi, USA*

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

Akira Nakajima, *Photocatalysis, Surface wettability, Ceramic processing, Tokyo Institute of Technology, Japan*

Cewen Nan, *Ferroelectric, Multiferroic materials, Tsinghua University, China*

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

Ian M. Reaney, *Electroceraamics, TEM, Thin films, The University of Sheffield, United Kingdom*

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

Fabrice Rossignol, *Ceramic processes, Additive manufacturing CNRS, France*

Edward M. Sabolsky, *Electroceraamics, Electrochemistry, Processing, West Virginia University, USA*

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

Susan B. Sinnott, *Computational materials science, The Pennsylvania State University, USA*

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

Mitra Taheri, *Metallic materials, Semiconductors, Complex Oxides, Drexel University, USA*

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

William J. Weber, *Radiation effects, Nuclear ceramics, University of Tennessee; Oak Ridge National Laboratory, 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, *JMR Production Assistant, Materials Research Society, Warrendale, PA*
Eileen M. Kiley, *Director of Communications, Materials Research Society, Warrendale, PA*

Cover: SEM images and diameter distribution of CNFs. [H. Zhao, X. Wu, J. Liu, Z. Huang, Y. Liu, M. Fang, X. Min: Processing and electrochemical properties of CNTs reinforced carbon nanofibers prepared by pressurized gyration. p. 4251].

Journal of MATERIALS RESEARCH

Volume 33, Number 24, December 28, 2018

INVITED PAPER

- 4135–4143 **Thermal stability study of transition metal perovskite sulfides** Shanyuan Niu, JoAnna Milam-Guerrero, Yucheng Zhou, Kevin Ye, Boyang Zhao, Brent C. Melot, Jayakanth Ravichandran

ARTICLES

- 4144–4155 **Influence of the anion nature on the properties of Sr-containing formamidinium tin halide perovskites** Lucangelo Dimesso
- 4156–4164 **Misfit strain relaxations of (101)-oriented ferroelectric $\text{PbTiO}_3/(\text{La}, \text{Sr})(\text{Al}, \text{Ta})\text{O}_3$ thin film systems** Yanpeng Feng, Yunlong Tang, Yinlian Zhu, Minjie Zou, Xiuliang Ma
- 4165–4172 **Synthesis and characterization of Ni incorporated titanium dioxide thin films** Deepak Kumar, Prasanta Mandal, Anil Singh, Charu Pant, Sudesh Sharma
- 4173–4181 **Preparation of core–shell nanostructured black nano- TiO_2 by sol–gel method combined with Mg reduction** Yuxin Li, Rong Fu, Xiangdong Wang, Xiaoling Guo

INVITED PAPER

- 4182–4191 **Si-doped high-energy $\text{Li}_{1.2}\text{Mn}_{0.54}\text{Ni}_{0.13}\text{Co}_{0.13}\text{O}_2$ cathode with improved capacity for lithium-ion batteries** Leah Nation, Yan Wu, Christine James, Yue Qi, Bob R. Powell, Brian W. Sheldon

ARTICLES

- 4192–4198 **Synthesis and properties of SnO_2 aerogels via ambient pressure drying of sol–gel** Haokun Li, Dachuan Zhu, Zhaoyun Yang
- 4199–4206 **Development of sandwich-structured cobalt porphyrin/niobium molybdate nanosheets catalyst for oxygen reduction** Mengjun Wang, Yan Liu, Xiaobo Zhang, Zichun Fan, Zhiwei Tong
- 4207–4214 **Transient transmission oscillations in doped and undoped lithium niobate induced by near-infrared femtosecond pulses** Bryan J. Crossman, Gregory J. Taft
- 4215–4223 **Assembly of Ni–Al layered double hydroxide and oxide graphene quantum dots for supercapacitors** Yuwan Han, Ning Liu, Nan Wang, Zhanhang He, Qingchao Liu
- 4224–4232 **Solvothermal synthesis of manganese sulfides and control of their phase and morphology** Jianchao Zhang, Rongrong Shi, Chen Zhang, Lingyun Li, Jiaming Mei, Shengqing Liu
- 4233–4240 **Single process CVD growth of hBN/Graphene heterostructures on copper thin films** Gene Siegel, Gordon Grzybowski, Timothy Prusnick, Michael Snure
- 4241–4250 **Competitive interplay of deposition and etching processes in atomic layer growth of cobalt and nickel metal films** Alexander Sasinska, Jennifer Leduc, Michael Frank, Lisa Czypiel, Thomas Fischer, Silke H. Christiansen, Sanjay Mathur

(Continued)

- 4251–4260 **Processing and electrochemical properties of CNT reinforced carbon nanofibers prepared by pressurized gyration** Hang Zhao, Xiaowen Wu, Jia Liu, Zhaohui Huang, Yan-gai Liu, Minghao Fang, Xin Min
- 4261–4269 **Synergistic effect of carbon nanotube and graphene nanoplatelet addition on microstructure and mechanical properties of AZ31 prepared using hot-pressing sintering** Liqun Wu, Ruizhi Wu, Jinghui Zhang, Legan Hou, Milin Zhang
- 4270–4277 **A novel, green, and biocompatible graphene-based carbonaceous material for immobilization of cytochrome c** Kuo Gai, Maoping Kang, Qian Huang, Sainan Zheng, Lei Zhang, Chaoliang Zhang, Liying Hao
- 4278–4286 **The delayed degradation mechanism and mechanical properties of β -TCP filler in poly(lactide-co-glycolide)/beta-tricalcium phosphate composite suture anchors during short-time degradation in vivo** You-Ran Luo, Li Zhang, Cheng Chen, Dong-Yuan Sun, Peng Wu, Yue Wang, Yun-Mao Liao, Xiao-Yan Cao, Cheng-Kung Cheng, Zi-Qing Tang, Xing Liang
- 4287–4295 **Enhanced bone regeneration of zirconia-toughened alumina nanocomposites using PA6/HA nanofiber coating via electrospinning** Hamid Esfahani, Mahsa Darvishghanbar, Behzad Farshid
- 4296–4306 **Material design and processing of a new class of titanium boride cermets with tough metallic phases and mechanical properties** Alexander Lark, Jun Du, K.S. Ravi Chandran
- 4307–4316 **Microstructure evolution and properties of in situ synthesized TiB₂-reinforced aluminum alloy by laser surface alloying** Tingting Zhang, Zhuguo Li, Kai Feng, Hiroyuki Kokawa, Yixiong Wu
- 4317–4328 **Effect of rolling reductions on microstructure and properties of 2Cr13/316L multi-layered steel composite plate by accumulative roll-bonding** Rui Cao, Yun Ding, Xiaokang Zhao, Xiaobo Zhang, XiaoXia Jiang, YingJie Yan, Jianhong Chen
- 4329–4339 **Microstructure and phase evolution in spark plasma sintering of the NbCr₂ Laves phase matrix composite toughened with ductile Cr phase** Kewei Li, Fei Gao, Lu Wang
- 4340–4348 **Effects of cerium and SiC mixed particles on nanoparticle strengthening activated TIG-welded AZ31 alloy joints** Fuxing Xie, Jun Shen, Huiyu Song, Xiong Xie
- 4349–4361 **Fabrication of Al7075–Al₂O_{3np}-based metal matrix composites with a high solid fraction for thixoforming** Xiao-Hui Chen, Hong Yan
- 4362–4376 **Additive manufacturing-enabled shape transformations via FFF 4D printing** Abishera Ravichandra Rajkumar, Kumar Shanmugam