Inside: **Using AI to accelerate materials development**

May 2019 Vol. 44 No. 5
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MRS Bulletin

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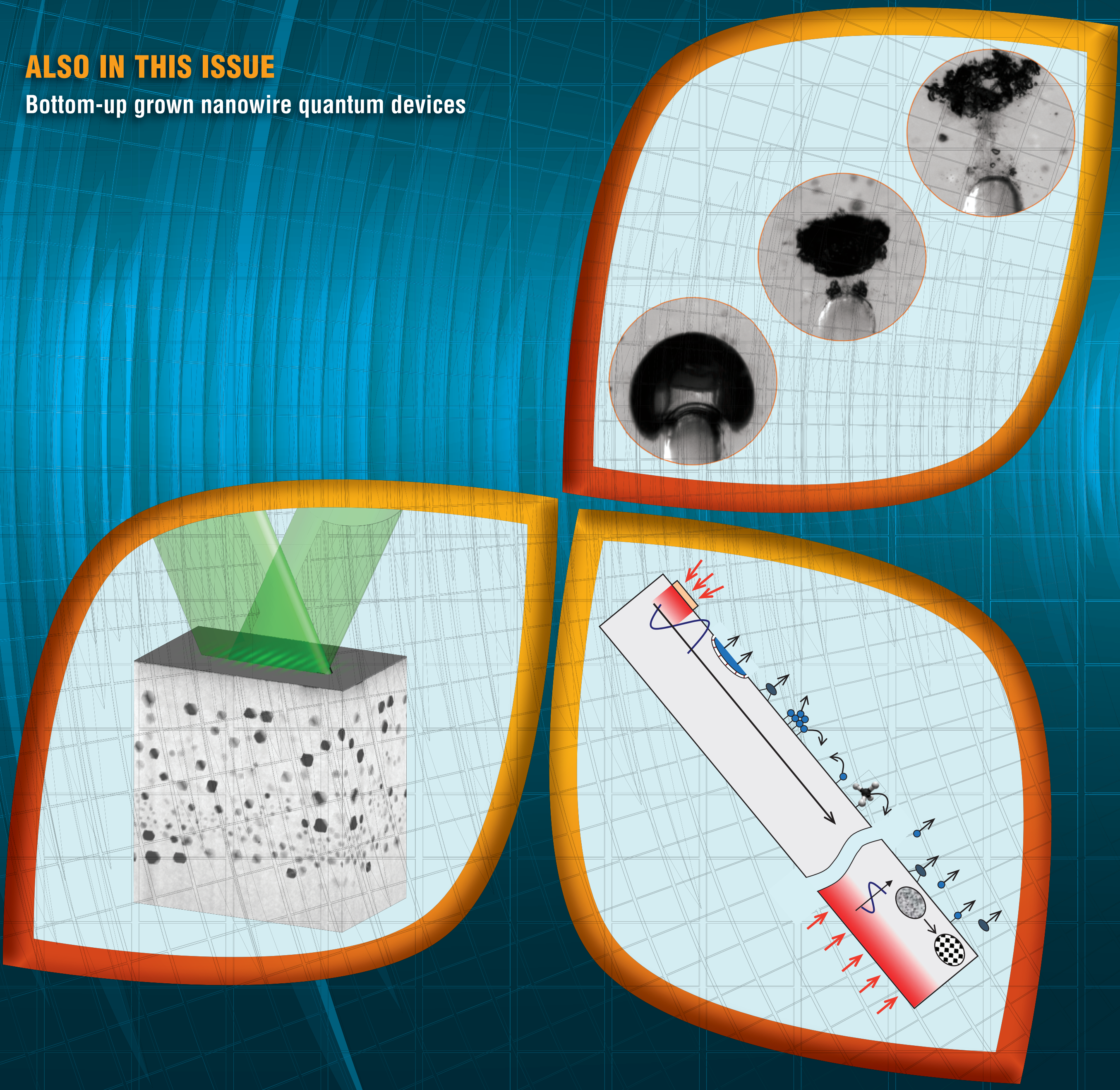
Acoustic processes in materials

ALSO IN THIS ISSUE

Bottom-up grown nanowire quantum devices



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https://doi.org/10.1557/mrs.2019.100 Published online by Cambridge University Press

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MRS Bulletin
MAY 2019 VOLUME 44 Number 5 ISSN: 0883-7694 CODEN: MRSBEA

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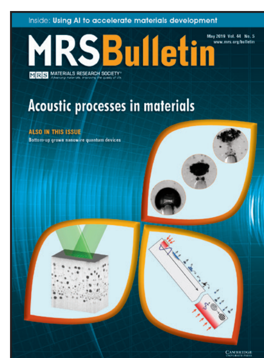

ON THE COVER

Acoustic processes in materials. The coupling of acoustic energy with materials structures and processes is at the core of emerging application areas in acoustically enabled materials characterization, structuring, and processing. Some of the promising and intriguing recent scientific and technical advances in the general area of acoustically enabled materials synthesis, processing, and characterization are reviewed in this issue of *MRS Bulletin*. The articles explore the revival of traditional application areas such as nondestructive evaluation and detection, as well as new opportunities that are expanding the range of acoustically enabled applications. See the technical theme that begins on page **345**.

COMING IN JUNE
Advances in *In Situ* Nanomechanical Testing

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EDITORIAL OFFICE 506 Keystone Drive, Warrendale, PA 15086-7573 USA
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The Materials Research Society (MRS), a not-for-profit scientific association founded in 1973 and headquartered in Warrendale, Pennsylvania, USA, promotes interdisciplinary materials research. Today, MRS is a growing, vibrant, member-driven organization of over 16,000 materials researchers spanning over 80 countries, from academia, industry, and government, and a recognized leader in the advancement of interdisciplinary materials research.

The Society's interdisciplinary approach differs from that of single-discipline professional societies because it promotes information exchange across many scientific and technical fields touching materials development. MRS conducts three major international annual meetings and also sponsors numerous single-topic scientific meetings. The Society recognizes professional and technical excellence and fosters technical interaction through University Chapters. In the international arena, MRS implements bilateral projects with partner organizations to benefit the worldwide materials community. The Materials Research Society Foundation helps the Society advance its mission by supporting various projects and initiatives.

MRS Bulletin (ISSN: 0883-7694, print; ISSN 1938-1425, online) is published monthly by the Materials Research Society, 506 Keystone Drive, Warrendale, PA 15086-7573. Periodical postage paid at New York, NY, and at additional mailing offices. POSTMASTER: Send address changes to *MRS Bulletin* in care of the Journals Department, Cambridge University Press, 100 Brook Hill Drive, West Nyack, NY 10994-2113, USA. Printed in the U.S.A.

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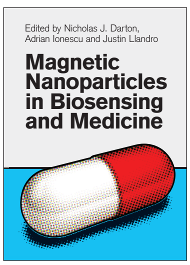
2019 BOOK COLLECTION

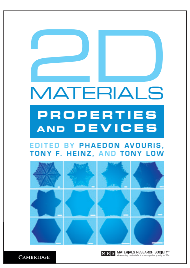
NEW TITLES



NEW!

Magnetic Nanoparticles in Biosensing and Medicine

EDITORS: Nicholas J. Darton, Adrian Ionescu and Justin Llandro
ISBN: 9781107031098
List Price: $140.00
MRS Member Price: $112.00



2D Materials—Properties and Devices

EDITORS: Phaedon Avouris, Tony F. Heinz and Tony Low
ISBN: 9781107163713
List Price: $100.00
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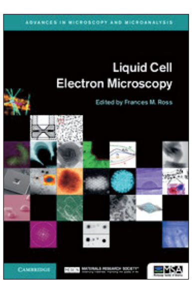

Liquid Cell Electron Microscopy

EDITOR: Frances M. Ross
ISBN: 9781107116573
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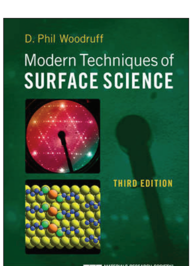
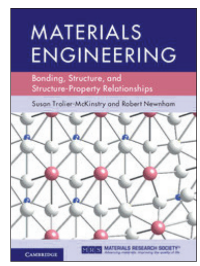


Modern Techniques of Surface Science
Third Edition

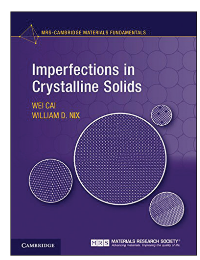
AUTHOR: D. Phil Woodruff
ISBN: 9781107023109
List Price: $110.00
MRS Member Price: $88.00

TEXTBOOKS



Materials Engineering—Bonding, Structure, and Structure-Property Relationships

AUTHORS: Susan Trolier-McKinstry and Robert E. Newnham
ISBN: 9781107103788
List Price: $95.00
MRS Member Price: $76.00



Imperfections in Crystalline Solids
First Textbook in the New MRS-Cambridge Materials Fundamentals Series

AUTHORS: Wei Cai and William D. Nix
ISBN: 9781107123137
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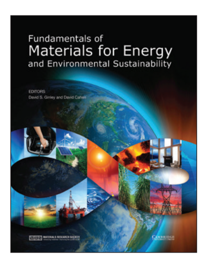
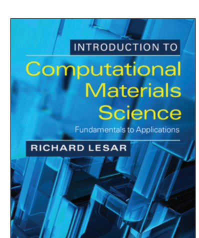


Fundamentals of Materials for Energy and Environmental Sustainability

EDITORS: David S. Ginley and David Cahen
ISBN: 9781107000230
List Price: $119.00
MRS Member Price: $95.00



Introduction to Computational Materials Science
Fundamentals to Applications

AUTHOR: Richard LeSar
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List Price: $95.00
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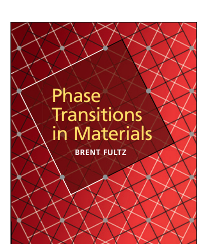

Phase Transitions in Materials

AUTHOR: Brent Fultz
ISBN: 9781107067240
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https://doi.org/10.1557/mrs.2019.100 Published online by Cambridge University Press

MRS JOURNAL HIGHLIGHTS

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3D printing of poly(ε-caprolactone)/poly(D,L-lactide-*co*-glycolide)/hydroxyapatite composite constructs for bone tissue engineering

Kazim K. Moncal, Dong N. Heo, Kevin P. Godzik, Donna M. Sosnoski, Oliver D. Mrowczynski, Elias Rizk, Veli Ozbolat, Scott M. Tucker, Ethan M. Gerhard, Madhuri Dey, Gregory S. Lewis, Jian Yang, Ibrahim T. Ozbolat

Polycaprolactone (PCL), poly(D,L-lactide-*co*-glycolide) (PLGA), and hydroxyapatite particles (HAps) composite inks were 3D-printed into porous constructs for bone tissue implants. *In vitro* studies revealed that the composite constructs had higher mechanical properties, quicker degradation profiles, and better cellular attachment and proliferation than PCL counterparts and *in vivo* studies showed stimulation of bone regeneration due to the presence of new mineralized bone tissue and considerable vascularization. **https://doi.org/10.1557/jmr.2018.111**

Tracer diffusion in single crystalline CoCrFeNi and CoCrFeMnNi high entropy alloys

Daniel Gaertner, Josua Kottke, Gerhard Wilde, Sergiy V. Divinski, Yury Chumlyakov

Self-diffusion of constituent elements was measured in equiatomic CoCrFeNi and CoCrFeMnNi single crystals for the first time using a radio tracer technique. Diffusion rates of 57Co, 51Cr, 59Fe, 54Mn, and 63Ni were significantly different at 1373 K, with Mn being the fastest and Co the slowest. In the quaternary alloy, Cu solute diffusion in CoCrFeNi was determined to be a fast diffuser below 1273 K. **https://doi.org/10.1557/jmr.2018.162**

External fields for the fabrication of highly mineralized hierarchical architectures

Hortense Le Ferrand

The current pathways for obtaining highly mineralized biomimetic composites using external magnetic, electric, and pressure fields in colloidal systems were reviewed and shown to have excellent potential for fabricating new and unique materials when coupled with additive manufacturing approaches. Future research directions are proposed to create highly mineralized materials with unprecedented functionalities. **https://doi.org/10.1557/jmr.2018.304**

Deposition routes of $Cs_2AgBiBr_6$ double perovskites for photovoltaic applications

Martina Pantaler, Christian Fettkenhauer, Hoang L. Nguyen, Irina Anusca, Doru C. Lupascu

Lead free perovskites continue to be an emphasis area for development of optical and solar applications. In this study the authors demonstrate and compare vapor and solution deposition routes to create a particular perovskite. The processing–structure relationships are shown to provide a snapshot into the processing conditions needed for further study to create ≈200 nm thick films. **https://doi.org/10.1557/adv.2018.151**

Design of porous metal-organic frameworks for adsorption driven thermal batteries

Daiane Damasceno Borges, Guillaume Maurin, Douglas S. Galvão

The authors provide a set of simulations to predict the performance for a new MOF for thermal energy storage applications (where the adsorption and desorption of a working fluid is directly related to temperature changes). Exploring new MOFs using DFT and subsequent simulations for water sorption show the organic linker in these systems dramatically impacts the affinity of the solid to the water, and suggests the ability to tune adsorption with relatively straightforward chemistry changes. **https://doi.org/10.1557/adv.2017.181**

Human stem cell derived osteocytes in bone-on-chip

E. Budyn, N. Gaci, S. Sanders, M. Bensidhoum, E. Schmidt, B. Cinquin, P. Tauc, H. Petite

Lab-on-a-chip has advanced localized chemistry; here the authors develop a bone-on-chip system that enables mechanical impulses to be applied to bone and cell structures. The system enables imaging of cell growth and behavior in physiologically relevant systems under mechanical stimulation. **https://doi.org/10.1557/adv.2018.278**

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