

Inside: Impact section featuring new research included in this issue!

# MRS Bulletin



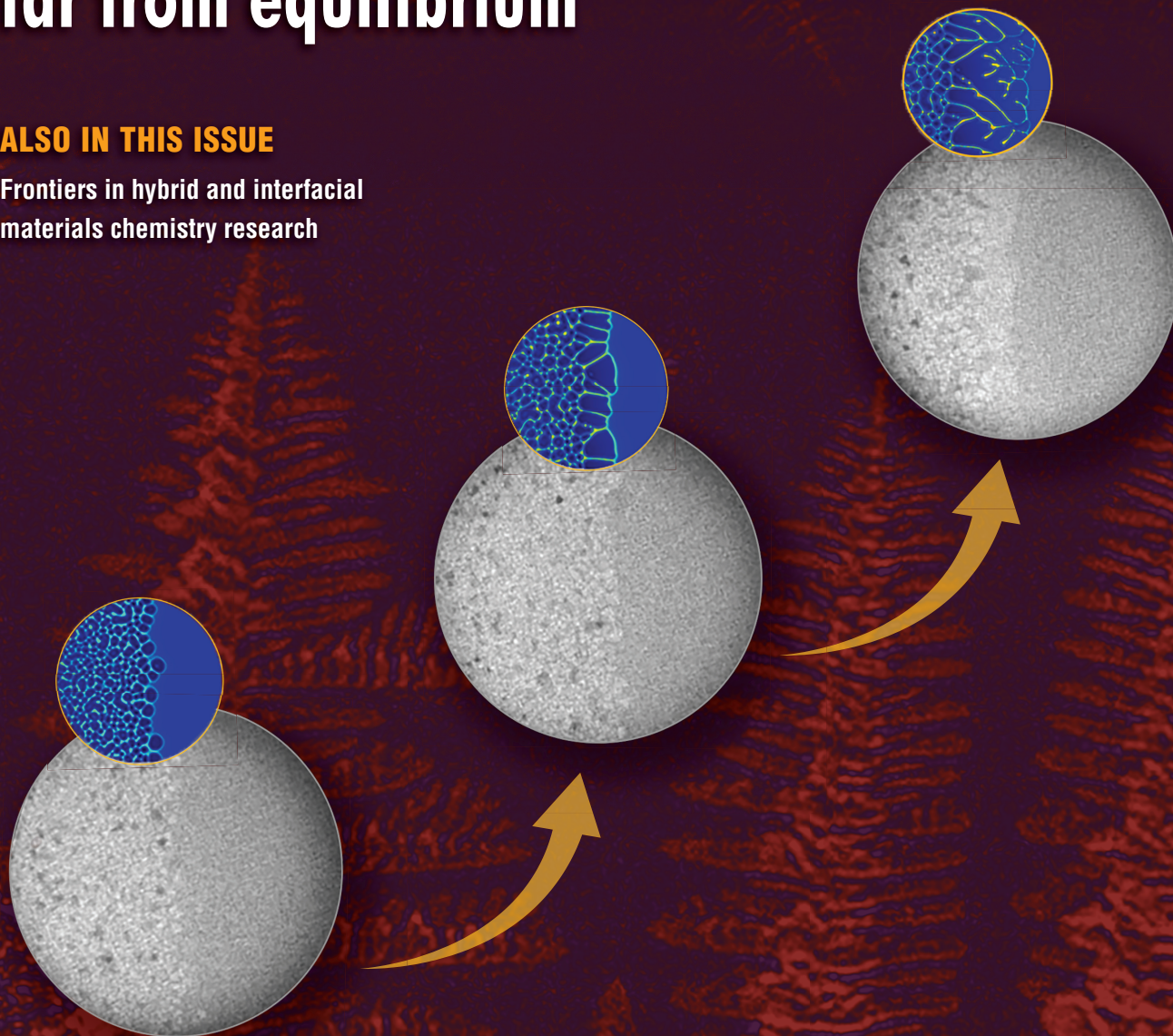
**MRS** MATERIALS RESEARCH SOCIETY®  
*Advancing materials. Improving the quality of life.*

November 2020 Vol. 45 No. 11  
mrs.org/bulletin

## Processing metallic materials far from equilibrium

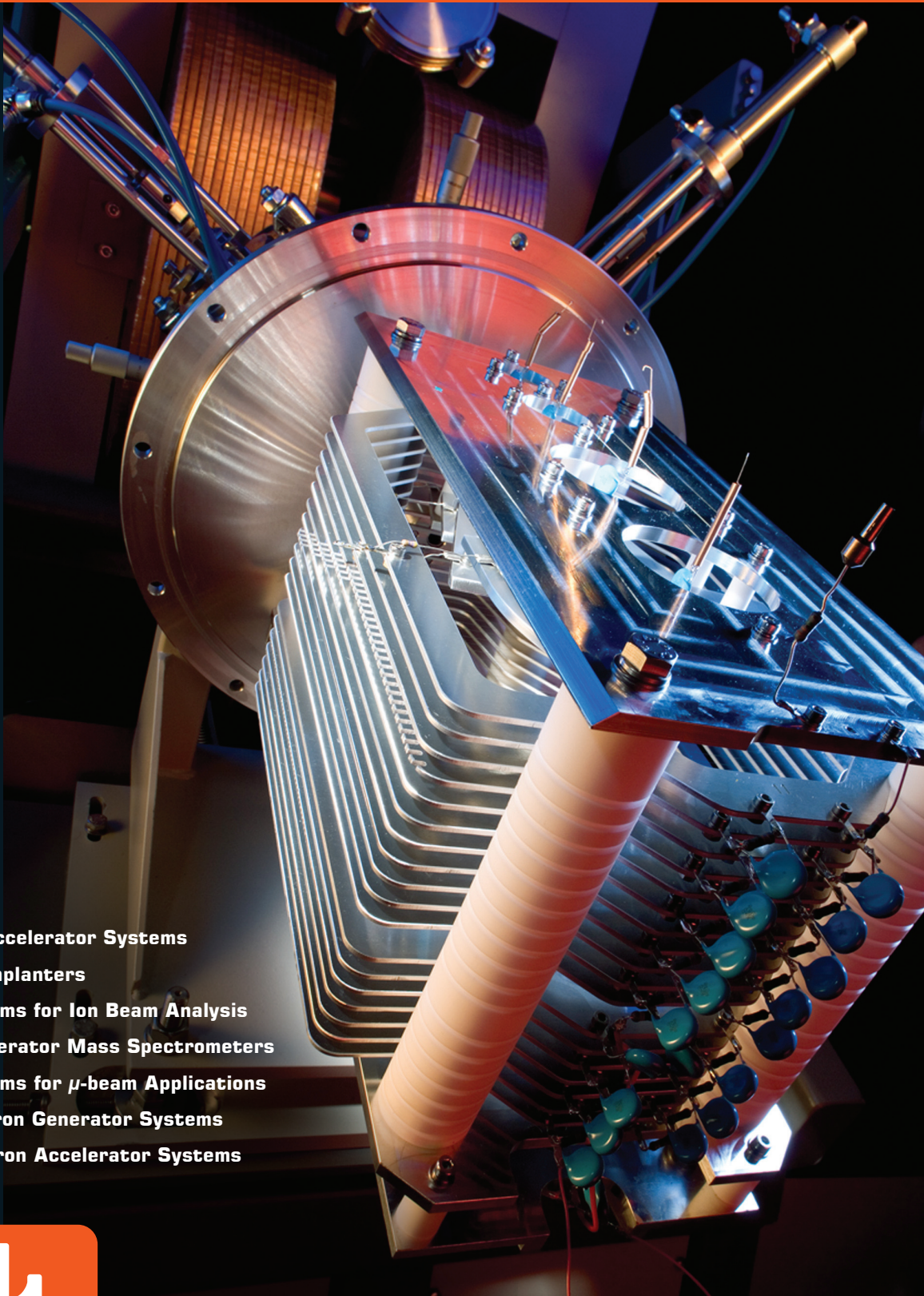
### ALSO IN THIS ISSUE

Frontiers in hybrid and interfacial  
materials chemistry research



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# PARTICLE ACCELERATOR SYSTEMS



- Ion Accelerator Systems
- Ion Implanters
- Systems for Ion Beam Analysis
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- Systems for  $\mu$ -beam Applications
- Neutron Generator Systems
- Electron Accelerator Systems



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THE NORWEGIAN ACADEMY OF SCIENCE AND LETTERS  
ANNOUNCES THE 2020 LAUREATES OF

# THE KAVLI PRIZE

## THE KAVLI PRIZE IN NANOSCIENCE

*“for sub-ångström resolution imaging  
and chemical analysis using electron beams”*

**Harald Rose**  
Universität Ulm  
GERMANY

**Maximilian Haider**  
CEOS GmbH  
GERMANY

**Knut Urban**  
Forschungszentrum Jülich  
GERMANY

**Ondrej L. Krivanek**  
Nion Co.  
USA

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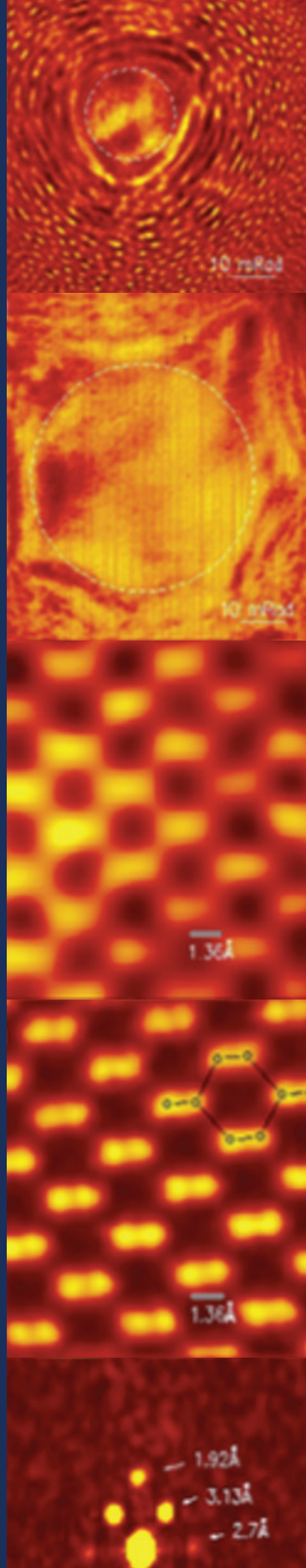
**Bodil Holst** (Chair), University of Bergen, Norway  
**Gabriel Aeppli**, Paul Scherrer Institut, Switzerland  
**Susan Coppersmith**, University of New South Wales, Australia  
**Shuit-Tong Lee**, Soochow University, China  
**Joachim Spatz**, Max Planck Institute for Medical Research, Germany

The 2020 Kavli Prize Laureates in Nanoscience are **Harald Rose**, for proposing a novel lens design, the Rose corrector, enabling aberration correction in transmission electron microscopy that can be applied to both conventional and scanning microscopes; **Maximilian Haider**, for the realization of the first sextupole corrector, based on Rose's design, and for his role in the implementation of the first aberration corrected conventional transmission electron microscope; **Knut Urban**, for his role in the implementation of the first aberration corrected conventional transmission electron microscope; and **Ondrej L. Krivanek**, for the realization of the first aberration corrected scanning transmission electron microscope with sub-ångström resolution, well suited for spatially resolved chemical analysis. This was obtained using a quadrupole-octupole corrector.



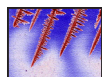
The Kavli Prize is a partnership among  
The Norwegian Academy of Science and Letters,  
The Norwegian Ministry of Education and Research,  
and The Kavli Foundation (USA).

Si (110) HADF image showing spacings down to 0.76 Å in  
a diffractogram. P.E. Batson et al., Nature 418 (2002) 617.

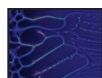


# CONTENTS

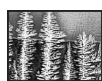
## PROCESSING METALLIC MATERIALS FAR FROM EQUILIBRIUM



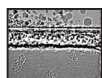
- 906 **Processing metallic materials far from equilibrium**  
Ashwin J. Shahani and Amy J. Clarke, Guest Editors



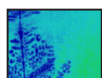
- 910 **Solute trapping in rapid solidification**  
Tatu Pinomaa, Anssi Laukkanen, and Nikolas Provatas



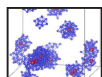
- 916 **Imaging transient solidification behavior**  
Joseph T. McKeown, Amy J. Clarke, and Jörg M.K. Wiezorek



- 927 **In situ/operando synchrotron x-ray studies of metal additive manufacturing**  
Tao Sun, Wenda Tan, Lianyi Chen, and Anthony Rollett



- 934 **In situ mapping of chemical segregation using synchrotron x-ray imaging**  
Shikang Feng, Enzo Liotti, Matthew D. Wilson, Lydia Jowitt, and Patrick S. Grant



- 943 **Changes in short- and medium-range order in metallic liquids during undercooling**  
M.J. Kramer and Mo Li

## TECHNICAL FEATURE



- 951 **Frontiers in hybrid and interfacial materials chemistry research**  
Beth S. Guiton, Morgan Stefik, Veronica Augustyn, Sarbajit Banerjee, Christopher J. Bardeen, Bart M. Bartlett, Jun Li, Vilma López-Mejías, Leonard R. MacGillivray, Amanda Morris, Efrain E. Rodriguez, Anna Cristina S. Samia, Haoran Sun, Peter Sutter, and Daniel R. Talham

## IMPACT SECTION



- 889 **Opinion & Perspective**  
**Nanomechanical measurements shed light on solid-state battery degradation**

Matthew T. McDowell

- 891 **Impact Article**  
**From ion to atom to dendrite: Formation and nanomechanical behavior of electrodeposited lithium**

Michael A. Citrin, Heng Yang, Simon K. Nieh, Joel Berry, Wenpei Gao, Xiaoqing Pan, David J. Srolovitz, and Julia R. Greer



### ON THE COVER

**Processing metallic materials far from equilibrium.** Recent rapid advances in modeling and real-time experiments with solidification of metals and alloys have yielded a wealth of new and quantitative information, expanding our understanding of the liquid-to-solid phase transition. This is critical to understand the formation of solid phases and their shapes and patterns from the disordered liquid environment. This issue of *MRS Bulletin* highlights developments in the field, including solidification at extreme rates, as well as the state of the art in computational and experimental techniques. The cover shows dynamic transmission electron microscope images of an Al-4Cu solid-liquid interface during the transition from incubation to growth with corresponding phase-field simulations, showing the interface morphology and grain structure. The background shows directional solidification of (upper) Al-Cu and (lower) Al-Si alloys observed through synchrotron x-ray images. Credit for image in foreground: J.T. McKeown, T. Pinomaa, J.M.K. Wiezorek, N. Provatas, A. Laukkanen, and T. Suhonen. Background: A.J. Clarke, S.D. Imhoff, P.J. Gibbs, J.W. Gibbs, K. Fezzaa, and D. Tourret. See the technical theme that begins on p. 906.



COMING IN DECEMBER 2020

Engineered proteins as multifunctional materials

## DEPARTMENTS



### OPINION

- 877 **Letter from the President**  
Pioneering a new publishing model  
Matt Copel
- 879 **Letter from the Editors**  
Reaching the horizon: First *MRS Bulletin Impact* articles published  
Markus J. Buehler and Gopal R. Rao



### NEWS & ANALYSIS

- 882 **Materials News**
- Glassy lithium forms superior metal anode for rechargeable Li batteries  
Aashutosh Mistry
  - Self-intercalation forms covalently bonded 2D transition-metal chalcogenide layers  
Tianyu Liu
  - Theoretical framework for charge transport in QD solids  
Ahmad R. Kirmani
- 885 **Science Policy**
- Quantum materials R&D forges ahead  
Judy Meiksin
  - EU announces European Green Deal €1 billion investment

#### Addendum

For the article, "Double transition-metal MXenes: Atomistic design of two-dimensional carbides and nitrides," which appeared in the October 45 (10), 850, issue of *MRS Bulletin*, Weichen Hong, Brian C. Wyatt, and Srinivasa Kartik Nemani contributed equally to this work.



### SOCIETY NEWS

- 880 **MRS Journal Highlights**
- 965 **2020 Virtual MRS Spring/Fall Meeting & Exhibit first of its kind for Society**
- 968 **MRS reports election results for 2021**
- 969 **Understanding and supporting the needs of early-career materials scientists**  
Thomas G. Folland, Mayra R.S. Castro, Isabel Gessner, Maria A. Philip, and Babak Anasori
- 971 **MRS responds to Executive Order on race and sex stereotyping**
- 972 **Looking back and thinking ahead: The Kavli Foundation celebrates 20 years**  
Lori A. Wilson



### FEATURES

- 976 **Postterminaries**  
Variation and variability  
Steve Moss



### CAREER CENTRAL

#### ADVERTISERS IN THIS ISSUE

#### Page No.

American Chemical Society, <i>C&amp;EN</i> .....	905
American Elements .....	Outside back cover
High Voltage Engineering .....	Inside front cover
The Kavli Foundation .....	873
Springer Nature .....	Inside back cover

connect

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## About the Materials Research Society

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 more than 14,000 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.

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