MRS JOURNAL HIGHLIGHTS

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Peptide-mediated binding of gold nanoparticles to *E. coli* for enhanced microbial fuel cell power generation

Justin P. Jahnke, Hong Dong, Deborah A. Sarkes, James J. Sumner, Dimitra N. Stratis-Cullum, Margaret M. Hurley

The use of bio- and nanoparticle materials and their enhanced synergistic effect demonstrates the harnessing of new phenomena toward useful catalytic effects. This article focuses on the investigation of gold nanoparticles to *E-coli* for enhanced microbial and fuel-cell power generation. The binding properties enhance bioelectrochemical charge transfer properties in general and can be mediated by surface interaction and binding with specific proteins.

https://doi.org/10.1557/mrc.2019.81

Utilizing additive manufacturing and gamified virtual simulation in the design of neuroprosthetics to improve pediatric outcomes

Albert Manero, Peter Smith, John Sparkman, Matt Dombrowski, Dominique Courbin, Paul Barclay, Albert Chi

Additive manufacturing (more popularly known as 3D printing) is used to translate design and function via digital manufacturing using innovative materials. In the biomedical world, the use of enhanced design via simulation takes advantage of the digital nature of manufacturing. In this work, the customization of a neuroprosthetic limb manufacturing process is more ably targeted to the clinical environment.

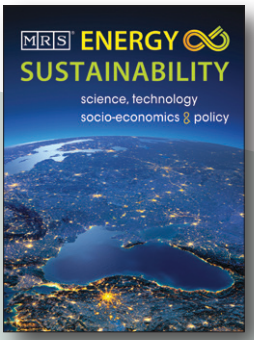
https://doi.org/10.1557/mrc.2019.99

On the thermal processing and mechanical properties of 3D-printed polyether ether ketone

Russell Wang, Kang-Jie Cheng, Rigoberto C. Advincula, Qiyi Chen

High-performance polymer materials are difficult to 3D print because of their high melting temperature and complex quenching to crystalline formation. The use of polyether ether ketone (PEEK) as a potential bone replacement necessitates studies that optimize their suitability for digital manufacturing. This article highlights the important parameters for optimizing thermo-mechanical properties of PEEK materials during fused deposition modeling 3D printing.

https://doi.org/10.1557/mrc.2019.86



An ode to polyethylene

Svetlana V. Boriskina

Most references to "polyethylene" are in the nature of "the current level of environmental plastic pollution is unsustainable." Polyethylene comprises a large volume of plastic waste because it is used in so many different products. There are, however, good reasons why polyethylene is one of the most widely produced materials in the world, and this review discusses various useful applications stemming from its unique material properties.

https://doi.org/10.1557/mre.2019.15

A few words from Dr. Y. Shirley Meng, the new Editor-in-Chief of *MRS Energy & Sustainability*

Y. Shirley Meng

Learn about the new Editor-in-Chief and her vision for the journal's future.

https://doi.org/10.1557/mre.2019.14

Deep decarbonization efforts in Norway for energy sustainability

Truls Norby, Emil H. Jensen, Sabrina Sartori

The authors look at Norway's policies and strategic actions to realize ambitious goals for energy sustainability and CO_2 emissions abatement from a technological and materials development standpoint. Among the largest exporters of fossil fuels, Norway compensates by intensive investments in the development of carbon capture and sequestration. With debates involving all of Norwegian society, the government has pursued aggressive strategies toward the decarbonization of energy production.

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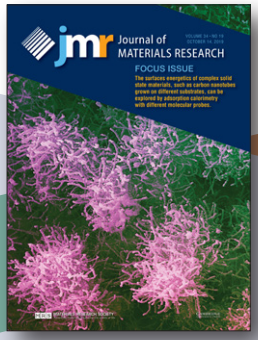

Optimization of anti-solvent engineering toward high performance perovskite solar cells

Jian Li , Ruihan Yang, Longcheng Que, Yafei Wang , Feng Wang, Jiang Wu, Shibin Li

Anti-solvent assisted crystallization is widely used to obtain high-quality perovskite films. Grain growth and phase composition of perovskite films are evaluated by x-ray diffraction, the scanning electron microscope, Fourier transform infrared spectrometer, and UV–vis absorption. The authors show that anti-solvents with a low boiling point and good polarity contribute to the superior efficiency and reproducibility of perovskite solar cells, and thus ether is shown to yield the best power conversion efficiency of 18.47%.
https://doi.org/10.1557/jmr.2019.122

Double resonance Raman scattering process in 2D materials

Rafael N. Gontijo, Geovani C. Resende, Cristiano Fantini, Bruno R. Carvalho

Characterization of 2D materials by Raman spectroscopy provides insights into electronic and vibrational properties. Double resonance Raman offers important information about the electron, phonon, and electron–phonon properties of carbon-related materials. The authors review the double resonance Raman process in 2D materials such as graphene and semiconducting MoS_2, and report guiding principles to find double resonance bands for both. They also discuss new findings of the intervalley scattering process in transition metal dichalcogenides. https://doi.org/10.1557/jmr.2019.167

Advances in *in situ* microfracture experimentation techniques: A case of nanoscale metal–metal multilayered materials

Hashina Parveen Anwar Ali, Arief Budiman

Plasticity and fracture at the nanoscale can deviate significantly from observed behavior in bulk properties. Nanoscale metal–metal multilayers are a good model platform to understand plasticity and fracture based on dislocation interactions with microstructural features. This review introduces the rationale and challenges of current microfracture testing methods and multilayer fracture behavior. Four examples of *in situ* fracture techniques are highlighted through tensile testing of film on a substrate: microfracture clamped beam bending technique across the multilayers, and delamination along the multilayered interface. https://doi.org/10.1557/jmr.2019.75

Characterization of AlN-based ceramic composites for use as millimeter wave susceptor materials at high temperature: High temperature thermal properties of AlN:Mo with 0.25% to 4.0% Mo by volume

Brad W. Hoff, Frederick W. Dynys, Steven C. Hayden, Rachael O. Grudt, Martin S. Hilario, Anthony E. Baros, Michele L. Ostraat

The authors provide a robust experimental data set that includes structural characterization, density, heat capacity, and thermal diffusivity measurements in a doped AlN ceramic. They model the thermal conductivity and predict the properties between room temperature to 1273 K. Ideas for methods to improve the thermal conductivity are also described. https://doi.org/10.1557/adv.2019.142

Application of low-cost Cu-Sn bimetal alloy as oxygen reduction reaction catalyst for improving performance of the microbial fuel cell

M.T. Noori, Gaurav Dhar Bhowmick, Bikash R. Tiwari, M.M. Ghangrekar, C.K. Mukherjee

Finding low-cost catalysts that can be fabricated for large scale usage is of great interest. The authors demonstrate a copper-tin alloy that performs similarly to a Pt-C catalyst in the fuel cell and structural characterization, and relate this to the electrochemical performance for water treatment. https://doi.org/10.1557/adv.2018.163

Exponential conductivity increase in strained MoS_2 via MEMS actuation

A. Vidana, S. Almeida, M. Martinez, E. Acosta, J. Mireles, T. -J. King, D. Zubia

Experimentally testing properties linked to mechanical deformation in two-dimensional materials presents many challenges. This international collaboration describes how to integrate moly-disulfide onto a MEMS actuator to apply over 3% strain to bilayered MoS_2 while measuring the electrical properties of the bilayer.
https://doi.org/10.1557/adv.2019.282

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