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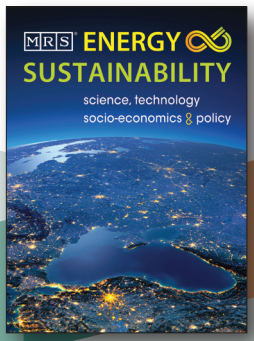


Sustainable design of fully recyclable all solid-state batteries

Darren H.S. Tan, Panpan Xu, Hedi Yang, Min-ceol Kim, Han Nhuyen, Erik A. Wu, Jean-Marie Doux, Abhik Banerjee, Ying Shirley Meng, Zheng Chen

With the rapidly increasing ubiquity of lithium-ion batteries, sustainable battery recycling is a matter of growing urgency. In this original research article, the authors demonstrate the first fully recycled all solid-state batteries and provide critical design consideration for future sustainable batteries. A scalable battery recycling strategy to recover and regenerate materials in spent all solid-state batteries will enable the reduction of energy consumption and greenhouse gases.
doi.org/10.1557/mre.2020.25

The use of decision support tools to accelerate the development of circular economic business models for hard disk drives and rare-earth magnets

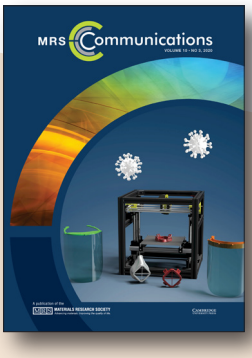
Kali Frost, Hongyue Jin, William Olson, Mark Schaffer, Gary Spencer, Carol Handwerker

Circular economy principles have been implemented by forward-thinking organizations to keep materials at their highest value use, with the ultimate goal of a zero-waste economy. The authors provide a case study of hard disk drives and rare-earth magnets, and the use of decision support tools to identify and assess the barriers and opportunities for low-risk circular business model experimentation.
doi.org/10.1557/mre.2020.21

Flexible and stretchable inorganic solar cells: Progress, challenges, and opportunities

Nazek El-Atab, Muhammad M. Hussain

Flexible and stretchable solar cells have gained growing attention in the last decade due to their ever-expanding range of applications from foldable electronics and robotics to wearables, transportation, and buildings. The authors review state-of-the-art research and development in the areas of flexible and stretchable inorganic solar cells, explain the principles behind the main technologies, highlight key applications, and discuss future challenges.
doi.org/10.1557/mre.2020.22



Electrocardiogram measurements in water using poly(3,4-ethylenedioxythiophene):poly(styrene sulfonate) nanosheets waterproofed by polyurethane film

Sho Mihara, Hui-Lin Lee, Shinji Takeoka

The applications of implantable devices, wearable electronics, and other biomedical devices rely on new materials-based and polymer-based electrodes with biocompatibility. The authors have demonstrated the possibility of using nanosheets of conducting polymers with high reliability for monitoring electrocardiograms through the flexible nature of these materials. doi.org/10.1557/mrc.2020.72

Electronic structure of technologically important interfaces and heterostructures

Richard Haight

The author focuses on looking at metal oxide semiconductor devices in a new light, given the ability to apply them to new device configurations and spectroscopic applications. The use of artificial intelligence and quantum computing will bring about a new paradigm in how these applications will be extended for years to come.
doi.org/10.1557/mrc.2020.63

MEMS-based dual temperature control measurement method for thermoelectric properties of individual nanowires

Yan Cui, Yang Yang, Shuai Liu, Sheng Dai, Tie Li, Yuelin Wang

Microelectromechanical systems-based devices enable high reliability and performance even at the microscale design level. Accurate measurements of the Seebeck effect are important for growth in future thermoelectric measurement technologies.
doi.org/10.1557/mrc.2020.66

https://doi.org/10.1557/mrs.2020.284 Published online by Cambridge University Press

Development of high-temperature oxide melt solution calorimetry for *p*-block element containing materials

Mykola Abramchuk, Kristina Lilova, Tamilarasan Subramani, Ray Yoo, Alexandra Navrotsky

The high-temperature oxide melt solution calorimetry is a reliable method developed to experimentally measure formation enthalpy. Until now, it has been mostly used for the characterization of oxide materials. We introduce modifications in the experimental technique, which make it suitable for a wide range of non-oxide compounds, providing a straightforward way of calculating the formation enthalpies of non-oxide systems based on high-temperature calorimetric experiments. doi.org/10.1557/jmr.2020.185

Recent trends on density functional theory-assisted calculations of structures and properties of metal–organic frameworks and metal–organic frameworks-derived nanocarbons

Oxana V. Kharissova, Boris I. Kharisov, Lucy T. González

Metal–organic frameworks (MOFs) possess tunable properties for catalysis, adsorption, and gas storage and separation applications. The authors review computational studies by density functional theory of MOF architecture, property predictions, and geometrical properties of hypothetical MOFs, diffusion and adsorption. Their work also presents chemical stability, optical and magnetic properties, photoluminescence, and semiconductor/metallic character. doi.org/10.1557/jmr.2020.109

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

The authors use hydrogen lithography to template phosphine-based surface chemistry to fabricate atomic-scale devices by atomic precision advanced manufacturing (APAM). Mid-infrared variable angle, spectroscopic ellipsometry of single-nanometer-thick phosphorus dopant layers (δ-layers) in silicon made by APAM show that APAM δ-layers function at room temperature. doi.org/10.1557/jmr.2020.155

Oxides and the high entropy regime: A new mix for engineering physical properties

P.B. Meisenheimer, J.T. Heron

The authors provide a snapshot review covering multicomponent oxides that address two key materials properties such as dielectric performance and magnetism. The materials highlighted are usually created via thin-film growth where control of the chemistry allows for novel structure formation that may not be viable with bulk processing. doi.org/10.1557/adv.2020.295

Solar-blind ultraviolet photodetectors based on vertical graphene-hexagonal boron nitride heterostructures

Jesse E. Thompson, Darian Smalley, Masahiro Ishigami

The authors describe a limitation to UV detection based on solar radiation and justify selecting hexagonal boron nitride (h-BN) systems for circumventing this problem. They highlight the processing methods used to form this structure over multi-millimeter square areas and provide initial results demonstrating its optical absorption around 200 nm. doi.org/10.1557/adv.2020.331

Shape-memory actuation of individual micro-/nanofibers

Yue Liu, Oliver E.C. Gould, Karl Kratz, Andreas Lendlein

Creating polymeric shape-memory materials will help enable motion and actuation in soft systems. Using a flat probe in a scanning probe system, the authors demonstrate that reversible strains of about 10% are feasible for PCL nanofibers with 300-nm diameters; the maximum strain decreases to approximately 3% with fiber diameters of 1000 nm. doi.org/10.1557/adv.2020.276

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