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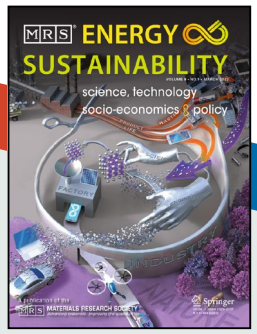

Lead-free materials: Prospective applications

Shujun Zhang, Barbara Malič, Jing-Feng Li, Jürgen Rödel

The next wave of explorations into ferroelectric materials may be related to the Internet of Things, which will promote research on ferroelectrics for sensing, energy harvesting and storage, communication and nonvolatile memories, from centimetre scale to micro- and nanoscale. The authors review the challenges and current status of lead-free ferroelectrics based on prospective applications. https://doi.org/10.1557/s43578-021-00180-y

Multiscale modeling of interface-mediated mechanical, thermal, and mass transport in heterogeneous materials: Perspectives and applications

Liming Xiong, Youping Chen, Irene J. Beyerlein, David McDowell

The authors characterize the multiscale nature of the mechanical, thermal, and mass transport behavior in a variety of materials with microstructure complexities and examine the applicability of several representative experimental and computational approaches in identifying the mechanisms underlying the interface-dictated mechanical, thermal, and mass transport. They highlight the need for development of multiscale methods that can address atomistic and continuum descriptions of materials within one framework. https://doi.org/10.1557/s43578-021-00293-4

Perspectives on multi-material additive manufacturing

Xiaoyu Zheng, Christopher Williams, Christopher M. Spadaccini, Kristina Shea

Future additive manufacturing (AM) systems that offer simultaneous processing of multiple materials in a single build open opportunities for new product functionality previously unachievable. The authors give a brief overview and aim to expand the notion of multi-material AM beyond combining materials with dissimilar properties to combinations of materials at different length scales, material classes as well as multiple functionalities. https://doi.org/10.1557/s43578-021-00388-y

Advanced aqueous redox flow batteries design: Ready for long-duration energy storage applications?

Zhejun Li, Yi-Chun Lu

Long-duration energy storage plays a significant role in the integration of intermittent and unstable renewable energy resources into future decarbonized grids. The authors present a top-down analysis of existing aqueous redox flow batteries (ARFBs) for long-duration applications, including ARFB cell configurations and materials design strategies for both membranes and redox active materials. These strategies serve as a guide for future advanced ARFBs in large-scale deployments. https://doi.org/10.1557/s43581-022-00027-x

Molybdenum-functionalized metal–organic framework crystals interconnected by carbon nanotubes as negative electrodes for supercapacitors

Yu-Hsiu Chen, Cheng-Hui Shen, Tzu-En Chang, Yi-Ching Wang, You-Liang Chen, Chung-Wei Kung

In this original research article, crystals of a water-stable Zr-based metal–organic framework (MOF), MOF-808, are directly grown on the surface of carboxylic acid-functionalized carbon nanotubes (CNTs) to synthesize the nanocomposites with tunable MOF-to-CNT ratios. Such pseudocapacitive materials show higher specific capacitances than the double-layer-type materials, and they can be operated in the negative potential window. https://doi.org/10.1557/s43581-022-00034-y

The second life of coffee can be even more energizing: Circularity of materials for bio-based electrochemical energy storage devices

Paolo Stufano, Alberto Perrotta, Rossella Labarile, Massimo Trotta

Open Access

Coffee is one of the most consumed beverages in the world and its consumption is associated with huge amounts of waste and spent coffee grounds. These wastes are interesting secondary raw materials for several circular economy concepts. In this article, the authors explain that nanostructured porous carbon materials obtained by coffee waste are emerging as active materials for electrochemical energy storage devices like supercapacitors and batteries. https://doi.org/10.1557/s43581-022-00036-w

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