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Lightweight complex metal hydrides for Li-, Na-, and Mg-based batteries

Matylda N. Guzik, Rana Mohtadi, Sabrina Sartori

Energy density and safety are main factors governing rechargeable battery technology development. Solid-state electrolytes (SSEs) that enable stable and reliable operation of all-solid-state Li-, Na-, and Mg-based batteries and improved capacity are highly desired. Lightweight complex metal hydrides are one of the most promising electrolyte materials for future electrochemical storage devices because of extraordinary ionic conductivities and, in some cases, electrochemical properties that enable battery reversibility. This paper overviews lightweight hydride-based materials for electrolytes and/or anodes in mono-/divalent batteries. https://doi.org/10.1557/jmr.2019.82

Atomistic modeling of nanoscale plasticity in high-entropy alloys

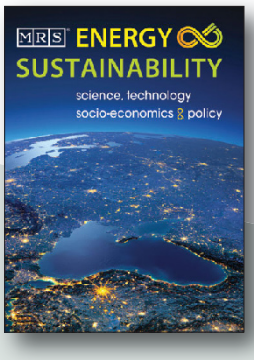
Zachary H. Aitken, Viacheslav Sorkin, Yong-Wei Zhang

This paper provides a state-of-the-art review of the techniques and results of atomistic simulations of lattice structures, defect structures, and deformation mechanisms of deformation in high-entropy alloys (HEAs). The authors focus on how atomistic simulations can elucidate the nanoscale mechanisms of plasticity underlying the outstanding properties of HEAs, and present a list of interesting problems for forthcoming atomistic simulations of HEAs.
https://doi.org/10.1557/jmr.2019.50

Recent progress in characterization of the core–shell structure of black titania

Mengkun Tian, Chenze Liu, Jingxuan Ge, David Geohegan, Gerd Duscher, Gyula Eres

Black titania has shown spectacular photocatalytic activity. Black titania often has a core–shell structure consisting of a perfect crystalline core surrounded by a defective surface shell. The authors review structure–functionality relationships in single-particle black titania by first introducing the crystal and electronic band structure of different TiO_2 phases, followed by the discussion of particle-size effects, the origin of lattice distortions, and phase control by synthesis.
https://doi.org/10.1557/jmr.2019.46



High-rate lithium-ion energy storage to facilitate increased penetration of photovoltaic systems in electricity grids

Alison Lennon, Yu Jiang, Charles Hall, Derwin Lau, Ning Song, Patrick Burr, Clare P. Grey, Kent J. Griffith

Energy storage for large grid scale has been the "holy grail" for the energy materials research community. High-rate lithium-ion batteries with ultra-long cycling lives (> 10,000 cycles) can provide electricity grid stabilization services in the presence of large fractions of intermittent generators, such as photovoltaics.
https://doi.org/10.1557/mre.2019.4

Why nonconventional materials are answers for sustainable agriculture

Caue Ribeiro, Marcelo Carmo

Nanotechnologies and nanosciences in materials can enable better solubilization, and consequently, better nutrient availability for plants, from fertilizers for instance, in a synchronized way, avoiding losses to the environment. The increase of agricultural production in a sustainable scenario is within reach if these nonconventional materials are systematically studied.
https://doi.org/10.1557/mre.2019.7

A generalized approach for selecting solar-energy system configurations for a wide range of applications

Pinchas Doron, Jacob Karni, Alexander Slocum

Selecting the suitable solar-energy system for a large and diverse range of applications requires careful consideration of the conventional Levelized Energy Cost (LEC) as well as other factors including Societal Impact Factor (SIF).
https://doi.org/10.1557/mre.2019.10

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