Can high-entropy materials boost highperformance energy storage communities?It is believed that this review will offer timely and comprehensive information on the future research directions of HEMs to boost high-performance energy storage communities. High-entropy materials (HEMs) have emerged as key players in energy storage technologies due to their unique properties. Which conductive materials are used for energy storage?More recently, highly crystalline conductive materials--such as metal organic frameworks (33 - 35), covalent organic frameworks (36), MXenes, and their composites, which form both 2D and 3D structures--have been used as electrodes for energy storage. Why do we need advanced electrochemical energy storage devices?The growing demand for advanced electrochemical energy storage devices highlights challenges in battery materials, such as limited storage sites, slow ion/electron transport, and structural instability, which collectively impede improvements in energy density, rate performance, cycle life, and battery safety. Which cathode materials provide faster energy storage?Many conventional cathode materials, such as LiFePO 4 or LiCoO 2, when downsized to the nanometer scale, can provide faster energy storage compared with the bulk counterparts (43). However, the energy storage mechanism changes, with the surface redox reaction becoming a dominant process. What are smart energy storage devices?Smart energy storage devices, which can deliver extra functions under external stimuli beyond energy storage, enable a wide range of applications. In particular, electrochromic (130), photoresponsive (131), self-healing (132), thermally responsive supercapacitors and batteries have been demonstrated. What are the applications of energy storage technology?These applications and the need to store energy harvested by triboelectric and piezoelectric generators (e.g., from muscle movements), as well as solar panels, wind power generators, heat sources, and moving machinery, call for considerable improvement and diversification of energy storage technology. Nanomaterials for Energy Storage Systems--A This review paper investigates the crucial role of nanotechnology in advancing energy storage technologies, with a specific focus on capacitors and batteries, including lithium-ion, sodium-sulfur, and redox flow. High-Entropy Design in Battery Materials for High Performance This framework systematically deciphers design principles, predicts performance trade-offs, and accelerates the translation of high-entropy materials into practical energy Global-optimized energy storage performance in multilayerZhou, M. et al. Novel sodium niobate-based lead-free ceramics as new environment-friendly energy storage materials with high energy density, high power density, High-Entropy Strategy for Electrochemical Energy Storage MaterialsIn this perspective, we start with the early development of high-entropy materials and the calculation of the configurational entropy. Then, we summarize the recent progress in Flexible electrodes for high-performance energy By connecting materials design with practical implementation, this work outlines a forward-looking framework for advancing the next generation of high-efficiency, flexible energy storage devices. Novel Materials for High-Performance Energy Storage DevicesBy navigating the intricate landscapes of these research endeavours, we aim to chart a comprehensive understanding of the potential and challenges associated with novel materials Regeneration of

high-performance materials for electrochemical This review provides a systematic overview of the regeneration of various solid wastes into energy storage materials from the point of view of processing techniques and value Atomic-Scale High-Entropy Design for Superior Based on atomic-scale investigations, a series of BNT-based high-entropy compositions are designed by introducing trace amounts of Mg and La to improve the electric breakdown strength and further Energy storage: The future enabled by These examples indicate that nanostructured materials and nanoarchitectured electrodes can provide solutions for designing and realizing high-energy, high-power, and long-lasting energy storage devices.Metal-based mesoporous frameworks as high-performance Additionally, the paper showcases a range of high-performance applications of these materials in the arena of energy storage and conversion. Finally, the review concludes Energy storage: The future enabled by The success of nanomaterials in energy storage applications has manifold aspects. Nanostructuring is becoming key in controlling the electrochemical performance and exploiting various charge Beyond biomimicry: Innovative bioinspired materials strategies Bioinspired materials hold great potential for transforming energy storage devices due to escalating demand for high-performance energy storage. Beyond biomimicry, High-Performance Relaxor Ferroelectric Materials Abstract Relaxor ferroelectrics usually possess low remnant polarizations and slim hystereses, which can provide high saturated polarizations and superior energy conversion efficiencies, thus receiving Nanocomposite phase change materials for high-performance Phase change materials (PCM) are deemed to be a great option for thermal energy storage (TES) with high energy density, but the low thermal conductivity of numerous Electrochemical energy storage performance of 2D Comment Open access Published: 11 June Electrochemical energy storage performance of 2D nanoarchitectured hybrid materials Jie Wang, Victor Malgras, Yoshiyuki Prospects and challenges of energy storage materials: A It is essential to incorporate novel, environmentally friendly, high-performance materials into energy conversion and storage applications to overcome the current energy and High-Performance Energy Storage and Conversion Metal oxides and carbon-based materials are the most promising electrode materials for a wide range of low-cost and highly efficient energy storage and conversion devices. Creating unique nanostructures High-performance and low-cost macroporous calcium oxide based materials Simple and cost-effective preparation method allows real, large scale application. High energy density, cycling stability, low cost and scalability are the main features required for Recent advancement in energy storage technologies and their Research has highlighted the need for advanced materials with high energy density and thermal conductivity to improve the overall performance of thermal energy storage Unlocking the potential of sepiolite: Designing high-performance energy Future studies should focus on the structural regulation of sepiolite and the development of large-scale preparation processes, in order to widely apply it in high A facile synthetic strategy to MnS/NC submicrospheres for high When evaluated as an anode material for SIBs, the composite exhibits exceptional long-term cycling performance, retaining a stable specific capacity of 167 mAh g -1 after High-performance composite phase change materials for

energy High-performance composite phase change materials (PCMs), as advanced energy storage materials, have been significantly developed in recent years owing to the progress in High-Performance Phase-Change Materials Based on Paraffin A tradeoff between high thermal conductivity and large thermal capacity for most organic phase change materials (PCMs) is of critical significance for the development of many Unlocking the potential of sepiolite: Designing high-performance energy Future studies should focus on the structural regulation of sepiolite and the development of large-scale preparation processes, in order to widely apply it in high High-performance composite phase change High-performance composite phase change materials (PCMs), as advanced energy storage materials, have been significantly developed in recent years owing to the progress in multifunctional 3D structural materials, including High-Performance Phase-Change Materials Based A tradeoff between high thermal conductivity and large thermal capacity for most organic phase change materials (PCMs) is of critical significance for the development of many thermal energy storage Atomic-Scale High-Entropy Design for Superior Dielectric ceramics with high energy storage performance are crucial for advanced high-power capacitors. Atomic-scale investigations determine that introduction of specific elements (Mg, La, Ca, and High-performance energy storage in BaTiO Abstract Dielectric energy-storage capacitors are of great importance for modern electronic technology and pulse power systems. However, the energy storage density (Wrec) Exploring the electrode materials for high-performance lithium-ion Review Article Exploring the electrode materials for high-performance lithium-ion batteries for energy storage application High-Performance Relaxor Ferroelectric Materials for Energy Storage Relaxor ferroelectrics usually possess low remnant polarizations and slim hystereses, which can provide high saturated polarizations and superior energy conversion efficiencies, thus receiving Data-driven design of carbon-based materials for high-performance With the rise of flexible electronics, the demand for advanced power sources has grown. Developing high-performance energy storage devices requires comprehensive Two-dimensional materials and their derivatives for high performance Phase change materials (PCMs) have garnered intensive attention due to their high energy density and stable energy output in the field of thermal energy storage. However, Bimetal-organic frameworks derived redox-type composite materials The use of Bi-MOF electrodes presents new avenues for the development of high-performance energy storage materials, with the potential for industrial energy storage High-performance and stress-controllable solid-solid phase Therefore, this study provides a new theoretical and practical basis for the development of high-performance S-S phase change materials with long-term thermal storage Synergistic Molecular Orbital-Cation Engineering in High-Entropy In this study, molecular orbital theory is employed to investigate properties of the high-performance cathode material NNCFMRTO, such as the electronic structure and interfacial Metal-based mesoporous frameworks as high-performance Additionally, the paper showcases a range of high-performance applications of these materials in the arena of energy storage and conversion. Finally, the review concludes High-Performance Phase-Change Materials Based on Paraffin A tradeoff between high

thermal conductivity and large thermal capacity for most organic phase change materials (PCMs) is of critical significance for the development of many