Does membrane structure design influence osmotic energy harvesting?This work underscores the critical role of membrane channel structure design in osmotic energy harvesting and serves as an inspiration for structural optimization and innovation of other 2D lamellar nanofluidic membranes. Can hydrocarbon ion-exchange membranes improve redox flow batteries?We report a molecularly engineered hydrocarbon ion-exchange membrane with interconnected subnanometer channels that enable fast and selective ion transport and boost the energy efficiency and operational stability of redox flow batteries. This work presents a pathway for developing high-performance membranes for redox flow batteries. Can 2D nanofluidic membranes be used for osmotic energy harvesting?Over the past decade, 2D nanofluidic membranes have emerged as promising avenues for osmotic energy harvesting 7, 8, 9, 10. Typically, water molecules and ions are transported in the confined space of 2D nanofluidic channels 11. Can nanocomposite membranes enhance salinity gradient power harvesting?Two-dimensional metal-organic framework nanocomposite membranes with shortened ion pathways for enhanced salinity gradient power harvesting. Chem. Eng. J. 484, 149649 (). Jia, X. et al. Enhanced selective ion transport in highly charged bacterial cellulose/boron nitride composite membranes for thermo-osmotic energy harvesting. Are membrane technologies a sustainable solution?Nature Sustainability 5, - () Cite this article Membrane technologies with low environmental impacts and ease of use have a wide spectrum of applications, with the potential to provide more sustainable solutions in domains such as water, energy and pollution treatment. Are ion-conducting membranes suitable for grid-scale redox flow battery systems?The ion selectivity of the ion-conducting membrane contributes to high efficiencies and a long lifespan of redox flow battery systems. However, grid-scale applications demark additional property requirements for the membranes. (1) Stability of membrane. Researchers in the lab of Kelsey Hatzell, an associate professor of mechanical and aerospace engineering and the Andlinger Center for Energy and the Environment, are demonstrating how membranes made from next-generation materials called MXenes (pronounced Maxines), a class of Researchers in the lab of Kelsey Hatzell, an associate professor of mechanical and aerospace engineering and the Andlinger Center for Energy and the Environment, are demonstrating how membranes made from next-generation materials called MXenes (pronounced Maxines), a class of Researchers in the lab of Kelsey Hatzell, an associate professor of mechanical and aerospace engineering and the Andlinger Center for Energy and the Environment, are demonstrating how membranes made from next-generation materials called MXenes (pronounced Maxines), a class of water-loving Polymer film capacitors are vital for power electronic systems due to their ultrafast charge-discharge capability, high power density, mechanical flexibility, and lightweight nature. However, achieving both high discharge energy density (Ud) and high energy-storage efficiency (?) in polymer Sulfonated poly (ether-ether-ketone) membranes We report a molecularly engineered hydrocarbon ion-exchange membrane with interconnected subnanometer channels that enable fast and selective ion transport and boost the energy efficiency and High-ion selectivity composite membrane based on sulfonated The VRFB assembled with the S/LUZ composite

membrane showed a coulombic efficiency (CE) of 89.1 % at a current density of 80 mA cm-2. In contrast, the values Turing-type nanochannel membranes with extrinsic ion transport Two-dimensional (2D) nanofluidic channels with confined transport pathways and abundant surface functional groups have been extensively investigated to achieve osmotic Ion-Conducting Membranes for Long-Duration Energy StorageDesigning highly selective membranes based on different transport behaviors of ions in ion transport channels benefits redox flow batteries for long-duration grid-scale energy High-Efficiency Energy Storage: High Entropy Materials Design This paper systematically explores the design principles of high-entropy materials with the aim of developing lithium-ion battery materials with high capacity and long cycle life. New materials make high-performance membranes the filters of Researchers in the lab of Kelsey Hatzell, an associate professor of mechanical and aerospace engineering and the Andlinger Center for Energy and the Environment, are Grand challenges in membrane applications--Energy Another scientific challenge remains to be addressed, i.e., obtaining an ion exchange membrane that can satisfy the need for energy storage and conversion devices, Significantly enhanced capacitive energy-storage performance of However, achieving both high discharge energy density (Ud) and high energy-storage efficiency (?) in polymer dielectrics remains a major challenge due to the intrinsic trade-off Polymeric membranes with aligned zeolite nanosheets forHere the authors show a synthetic route to a polymeric membrane that breaks the conductivity-selectivity trade-off and enables exciting performance in a vanadium flow Dual-mechanism enhanced energy efficiency of nanofiber The spiny structure of Cu-CAT has high photothermal efficiency, and the surface temperature of the Cu-CAT@PA6 NM reaches 68 °C. The fluffy middle layer can store heat Functional materials with high-efficiency energy storage and For the aspect of energy storage, high efficiency is closely connected with lightweight and high energy density materials, such as hydrogen, lithium, and magnesium. Engineered sulfonated porous carbon/cellulose nanofiber hybrid membrane The introduction of sulfonated porous carbon significantly reduce the energy barrier of ion transport through the T-CNF membrane, exhibiting a high energy conversion High-ion selectivity composite membrane based on sulfonated VRFB, as a type of electrochemical energy storage device, allows for the design of a specific capacity, safety, and reliability. The low cost, long life and high safety of the Evaluating membranes for hydrogen storage and utilization in This study aims to provide a comprehensive evaluation of membrane technologies for hydrogen-related processes in aviation, specifically focusing on hydrogen Unifying the Conversation: Membrane Separation Dense polymer membranes enable a diverse range of separations and clean energy technologies, including gas separation, water treatment, and renewable fuel production or conversion. The transport of Novel microporous sulfonated polyimide membranes with high energy The intermittency and instability of solar and wind energy makes these renewable energy supply continuously and smoothly very challenge [[1], [2]]. As a large-scale energy Thermodynamic performance study of hydrogen-oxygenAs a competitive energy storage method, hydrogen storage plays a vital role in improving the utilization of renewable energy and reducing

carbon emissions. This paper Axially aligned COF membranes unlock high The pursuit of osmotic energy has gained momentum due to environmental concerns. Jiang et al. developed a metal-ion-coordination-assisted orientation strategy for constructing axially aligned covalent Sulfonated poly (ether-ether-ketone) membranes Redox flow batteries (RFBs) are promising for long-duration grid-scale sustainable energy storage. The ion-exchange membrane is a key component that determines energy efficiency and cycling stability. Two-dimensional material separation membranes for renewable energy The current energy crisis has prompted the development of new energy sources and energy storage/conversion devices. Membranes, as the key component, not only provide Metal-Organic Framework-Based Membranes with As a novel type of energy storage technology, non-aqueous redox flow batteries (NARFBs) have shown great potential in the fields of grid peaking and renewable energy storage due to the advantages of high Axial alignment of covalent organic framework membranes for This work shows a strategy to engineer the orientation of covalent organic framework membranes to an axis-aligned configuration that enables record performance for Sulfonated poly (ether-ether-ketone) membranes with intrinsic Redox flow batteries (RFBs) are promising for long-duration grid-scale sustainable energy storage. The ion-exchange membrane is a key component that determines High-pressure proton exchange membrane water electrolysis: Abstract High-pressure proton exchange membrane (PEM) water electrolysis for hydrogen production is a crucial method to achieve low energy consumption, high efficiency, Metal-Organic Framework-Based Membranes with As a novel type of energy storage technology, non-aqueous redox flow batteries (NARFBs) have shown great potential in the fields of grid peaking and renewable energy storage due to the advantages of high High-pressure proton exchange membrane water electrolysis: Abstract High-pressure proton exchange membrane (PEM) water electrolysis for hydrogen production is a crucial method to achieve low energy consumption, high efficiency, Advances and prospects to achieve high-performing and durable The PEM-URFC offers a practical solution to managing these intermittent and variable energy sources owing to its high scale-up efficiency benefited from the decoupled Functional Membranes for High Efficiency This book provides an overview of functional membranes for efficient ion/molecule transfer and separation. It first presents the design, fabrication, structure, and performance of several kinds of membranes. High-performance aqueous organic redox flow battery enabled by Aqueous organic redox flow batteries (AORFBs) have become a promising electrochemical energy storage technology due to their low cost, high safety, an Scalable fabrication of integrated covalent organic framework membrane Abstract Interfacial polymerization (IP) is a promising approach for preparing covalent organic framework (COF) membranes in energy storage and conversion applications. A high-energy efficiency static membrane-free As a promising energy storage system, aqueous zinc-bromine batteries (ZBBs) provide high voltage and reversibility. However, they generally suffer from serious self-discharge and corrosion High-efficiency energy storage membrane brings new hope for According to Science Daily, the National University of Singapore Institute of Nanotechnology has recently

developed a new high-efficiency energy storage membrane. This new product is not Efficiency Enhancement of an Ammonia-Based Solar Thermochemical Energy The ammonia-based solar thermochemical energy storage (TCES) is one of the most promising solar TCESs. However, the solar-to-electric efficiency is still not high enough Free-Standing Covalent Organic Framework Membrane for High-Efficiency Free-standing covalent-organic-framework-based membranes with excellent stability and mechanical properties were fabricated. The membranes have one-dimensional Polymeric membranes with aligned zeolite nanosheets forAs a result, pairing this aligned membrane with a vanadium flow battery leads to a high energy efficiency of >80% at 200 mA cm-2 and remarkable stability over 1,000 cycles. Design and economic analysis of high-pressure proton exchange membrane The proton exchange membrane (PEM) electrolysis with a high-pressure cathode can help avoid the utilization of a hydrogen compressor and improve the efficiency of hydrogen Functional materials with high-efficiency energy storage and For the aspect of energy storage, high efficiency is closely connected with lightweight and high energy density materials, such as hydrogen, lithium, and magnesium.

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