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Lithium Protection and Dendrite Suppression

A multifunctional membrane separator enhances the efficiency, safety, and lifespan of next-generation metal batteries by suppressing lithium dendrite formation and selectively regulating ion flow.

As high performing electronic devices, e.g., cell phone, electric vehicles, are prevalently utilized in our lives, the demand for secondary batteries with high energy density, enhanced safety, and long cycle life has highly increased. Lithium (Li) metal has received attention as a promising anode candidate due to its high theoretical capacity, lowest negative potential, and it's potential as next-generation energy storage in Li-ion batteries, where Li metal electrode is necessary for the system. However, systemic issues result in poor electrochemical performances and safety problems such as short-circuits. A need exists for a method to reduce the unstable properties of Li metal electrodes.

Researchers at Purdue University have developed a multifunctional membrane separator to uniformly distribute Li-ion flux to minimize the lithium dendritic growth, eventually suppressing Li dendrites formation. Structural and materialistic benefits of the membrane allow significant enhancement of electrochemical performances of Li metal batteries. In addition, the membrane selectively allows Li ions to pass through the membrane while preventing the passage of unwanted compounds, effectively increasing efficiency and extending the lifetime of the metal batteries. The membrane can be coupled with next-generation batteries, e.g., Li-S, Li-air, requiring Li metal (or Na metal) as an anode and easily and effectively increase the energy density of secondary batteries. The selection of material for designing the membrane can be expanded to other types of material to advance the development and commercialization of practical metal batteries.

Advantages:

-Enhanced electrochemical performance to make safer batteries

Technology ID

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Category

Automotive & Mobility
Tech/Battery Management & Charging Technologies
Energy & Power Systems/Energy Storage
Materials Science & Nanotechnology/Advanced Functional Materials

Authors

Patrick JH Kim
Vilas Pol

Further information

Will Buchanan
wdbuchanan@prf.org

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-High efficiency from Li or Na ion batteries

-Extended battery lifetime due to lithium dendrite suppression

-Works with multiple types of material

Potential Applications:

-Battery manufacturers

-Electronics

-Electric vehicles

TRL: 5

Intellectual Property:

Provisional-Patent, 2017-12-22, United States | Utility Patent, 2018-12-20, United States | DIV-Gov. Funding, 2023-05-31, United States

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