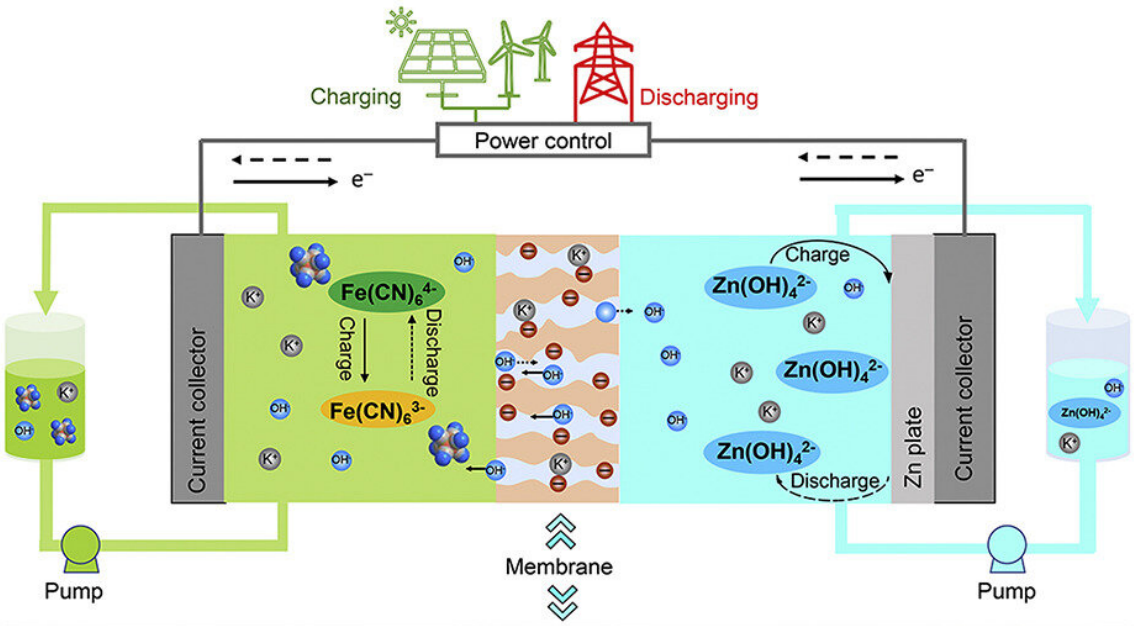
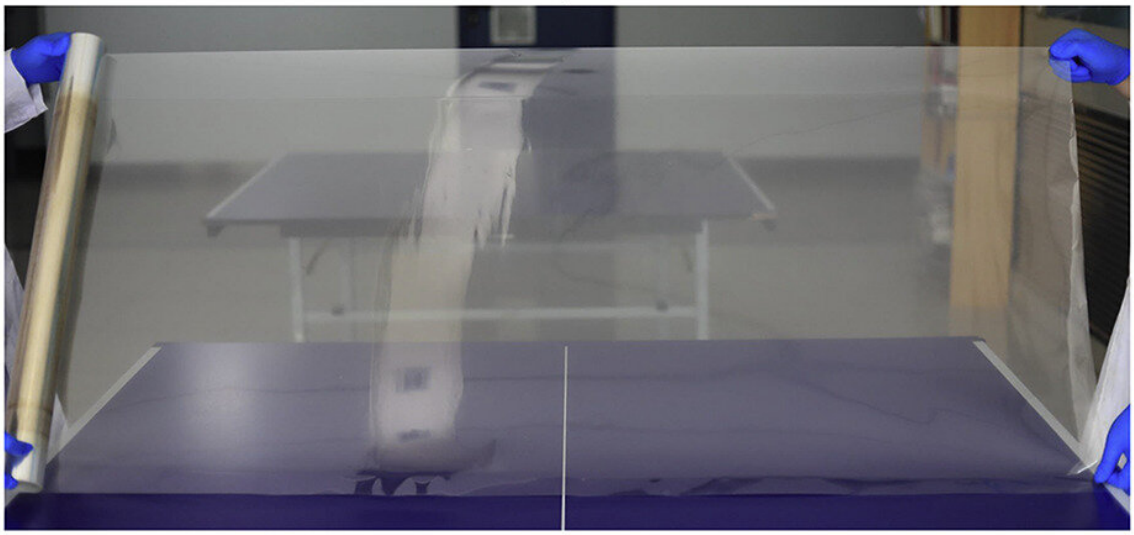
Low-cost hydrocarbon membrane enables commercial-scale flow batteries for long-duration energy storage

March 28 2022, by Li Yuan





Graphical abstract. Credit: *Joule* (2022). DOI: 10.1016/j.joule.2022.02.016

Flow batteries are promising for energy storage due to their high safety, high reliability, long cycle life, and high efficiency.

The development of commercial-scale flow batteries for long-duration energy storage requires to reduce the cost of flow batteries, especially the cost of ion-exchange membranes.

Recently, a research group led by Prof. Li Xianfeng from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) realized pilot-scale synthesis and roll-to-roll manufacturing of hydrocarbon membranes with high-performance in alkaline-based flow batteries.

This work was published in *Joule* on March 21.

The researchers realized the kilogram-level synthesis of sulfonated poly(ether-ether-ketone) (SPEEK) polymer and demonstrated the pilot-scale roll-to-roll synthesis of SPEEK membrane and their applications in alkaline-based flow batteries.

They found that the rigid skeleton and dispersive cation exchange groups enabled the high stability of the membrane in alkaline media, and could confine O-containing species (H_2O, OH^-, etc.) inside the membrane, resulting in the formation of continuous hydrogen-bonding networks. This favored the dissociation of H^+ in H–O–H (H_2O) and transfer from H_2O to adjacent OH^- ions through a Grotthuss mechanism, thus providing a high OH^- conductivity in SPEEK.

The membrane was integrated in alkaline zinc-iron flow battery stack with power up to 4 kW, with a high energy efficiency of 85.5% operated at 80 mA/cm^2.

More information: Zhizhang Yuan et al, Low-cost hydrocarbon membrane enables commercial-scale flow batteries for long-duration energy storage, *Joule* (2022). DOI: 10.1016/j.joule.2022.02.016

Provided by Chinese Academy of Sciences