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Polyampholyte hydrogel electrolytes for flexible and self-healing aqueous supercapacitor for low temperature applications HYUN-JOONG CHUNG, XINDA LI, University of Alberta — Quenched polyampholytes provide a novel class of tough hydrogel that has self-healing ability, strong adhesion, and mechanical flexibility. In this study, we show that the polyampholyte hydrogels can be utilized as an aqueous gel electrolyte material that is especially useful for low temperature operations; at –30 C, energy density of 10.5 Wh/kg at a power density of 500 W/kg was achieved. The high performance at the low temperature is associated to the concept of non-freezable water near the hydrophilic polymer chains. A comparison between differential scanning calorimetry (DSC) measurements for polyampholytes that contained KOH and neat KOH solution revealed that increased amount of water molecules become non-freezable when the solution is contained in the hydrogel networks. In addition, the crosslinked network structure of the polyampholyte chains disrupts the crystalline growth of ice, resulting in 'slush-like' ice formation. The interplay between the increased amount of unfrozen water and the limited growth of ice crystals leads to the enhanced supercapacitor performance at low temperatures.

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