



Composite PAAm-based hydrogel electrolyte for hybrid aqueous (Zn-Li-ion) battery

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Hybrid aqueous rechargeable batteries are very attractive alternative to conventional rechargeable lithium ion batteries for stationary application because of production and usage safety, reduced production cost and environmental friendliness. Previously aqueous rechargeable batteries with Zn/LiCl-ZnCl₂/LiFePO₄ system with liquid electrolyte has been reported [1]. The system performed a high rate capability up to 60 C with the average operation voltage 1.2 V and cycling performance with a capacity retention of 80 % over 400 cycles at 6 C.

However, there are several drawbacks including water decomposition and zinc dendrite formation hindering the commercialization [1]. The present study aimed to develop a PAAm-based hydrogel electrolyte with inclusion of montmorillonite and halloysite clay nanoparticles for hybrid aqueous rechargeable zinc/lithium ion batteries to overcome above mentioned problems. Polyacrylamide hydrogel was chosen because of its high ionic conductivity, high water content and simple fabrication method in which cross-linking degree, thickness, etc. were optimized. Inclusion of clay could improve mechanical stability of hydrogel electrolyte, prevent water decomposition and dendrite formation.

All tests performed in Zn/LiFePO₄ cell operating in an optimized LiCl/ZnCl₂ aqueous electrolyte based hydrogel.

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References

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