

Hydrophilic adhesive polymer binder for high-performance seawater batteries

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Conventional hydrophobic binders [e.g., poly(vinylidene fluoride) (PvdF), Nafion] can cause various problems such as an unstable charge-discharge reaction and low performance due to low wettability toward seawater and poor adhesion property. The hydrophilic adhesive polymer binder is achieved via using three moieties; (i) dopamine methacrylamide (DMA) as an adhesive moiety, (ii) Poly(ethylene glycol) (PEG) as a hydrophilic moiety, and (iii) Poly(ethylene glycol) diacrylate (PEGDA) to prevent polymer binder from dissolving into seawater. The synthesized polymer showed excellent adhesion against carbon felt and Pt surface, which is measured by surface force apparatus (SFA). Moreover, the seawater battery with the polymer binder showed higher power and cycle stability compared to that of PvdF binder. The cross-section of carbon felt was imaged with transmission electron microscopy (TEM), which directly showed that the synthesized polymer binder prevents Pt/C from detachment and protection against carbon corrosion during the charge-discharge cycle.