Modification of alginate polysaccharide and its application to binder materials for lithium ion battery anodes

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Compared to commercial organic-soluble binders, natural polysaccharides have been used as water soluble binders to improve an electrochemical performance of high-capacity silicon anode in lithium ion batteries due to their intrinsic adhesive characteristics. However, it has been still demanded that the nonionic properties and adhesion ability of polysaccharide should be further enhanced through a variety of ways; introduction of polar groups, graft copolymerization, and crosslinking of polymer matrix. In this study, we first synthesize a functionalized alginate by introducing sulfonic acid groups to the backbone of alginate, noted as SAlg, and then the SAlg is grafted with polyacrylamide (PAAm) under a redox initiator system. This modified polysaccharide, called as SAlg-g-PAAm, is employed as a polymer binder material for high-capacity silicon/graphite composite anodes. The effect of the sulfonic acid group on ionic conductivity and of grafting and crosslinking with PAAm on the adhesion ability is thoroughly investigated and compared alginate and non-crosslinked graft copolymer.