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Improvement of the electrochemical performance of Si anodes by use of ultrathin polydopamine coating upon conductive carbon particles

D Song

Hanbat National University, South Korea

Although silicon (Si) have received worldwide attention as a promising anode candidate because they are not only able to provide high theoretical capacity $\sim 3500 \text{ mAh g}^{-1}$ but also cheap and environmentally friendly source, a successful implementation of Si anode based lithium-ion batteries (LIBs) has been hindered so far. This is because Si anodes suffer from huge volume change (c.a. 300%) during cycling. To improve cycle performance of Si anode based LIBs, the mechanical stress should be efficiently alleviated. In this study, we developed surface modified conductive additive by using a mussel-inspired polymeric material: polydopamine (PD). Due to hydrophilic moiety of PD coating layer, PD-treated Super-P was well dispersed in the water. Thus, we could use polyacrylic acid (PAA) as a polymeric binder. PD-treated Super-P achieved highly improved cycle performance of Si anodes. Using FT-IR, we verified that the improved cycle performance is attributable to the newly formed covalent bonds between the amine group in PD-treated Super-P and the hydroxyl group in PAA. Furthermore, we evaluated adhesion property of anode composite using a surface and interfacial cutting analysis system (SAICAS). PD-treated Super-P showed the highest adhesion value compared to bare Super-P.

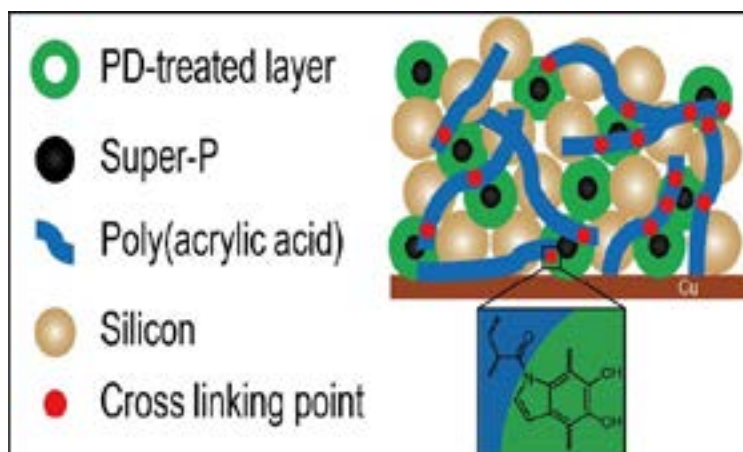


Figure 1: A graphical illustration of the cross-linked PD-treated Super-P for Si anodes

Biography

D Song has been studying about Lithium Secondary Batteries at Hanbat National University as MS candidate. He intensively researches on silicon anode and lithium metal anode using lithium secondary component. He has improved the adhesion of electrodes through research and other new methods so far. His research will greatly help in the commercialization of silicon.

danoh.song@hanbat.ac.kr

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