Self-assembled Si/graphene-based composites for high capacity lithium-ion battery anodes

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Energy storage devices based on lithium-ion batteries (LIBs) with high energy density are highly demanding in many electrified vehicles (x-EV). As anode material for LIBs, commercial graphite have shown its limitation in increasing the energy density of LIBs due to its low theoretical capacity (372mAh/g). Among many candidates, silicon is the most attractive one because of its high theoretical capacity (3572 mAh/g) and relatively low working voltage. However, its huge volume expansion (~300%) during cycling causes electrode pulverization leading to excessive electrolyte consumption and finally to deterioration of cycle stability. To tackle these problems, we fabricated novel Si/graphene/C composites. For this purpose, we used an electrostatic self-assembly between amine-functionalized Si nanoparticles (SiNPs) and graphene oxide (GO) in an acidic solution followed by additional carbon coating on Si/GO assemblies to form rigid carbon scaffold on the outer surface of Si/graphene particles. The Si/graphene/C composites showed much improved cycling stability than Si/graphene composite. Their electrochemical properties were characterized by cycling test, cyclic voltammetry (CV) and impedance analysis. etc.