MoS_2 Nanosheets Vertically Grown on the Carbonized Corn Stalks for Lithium Ion Battery Anode

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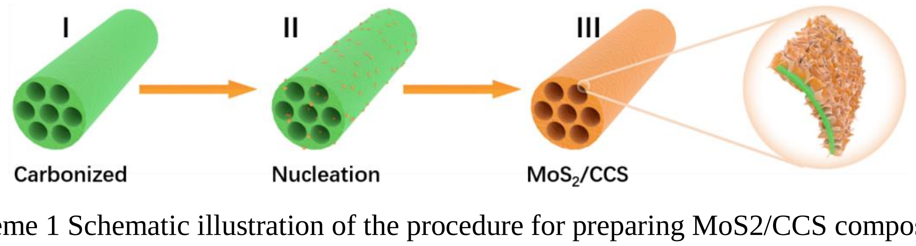
Graphite, as a traditional anode material, has been immensely used in LIBs. Despite the low price of the graphite, it still faces many problems, such as the low theoretical capacity and very limited rate performance. More importantly, a lot of graphite from artificial mining, as people's demand for LIBs gradually increased, graphite will one day face the depletion of resources like oil and natural gas. Recently, the transition-metal sulfides, due to the high specific capacity, design adaptability, has attracted a lot of attention. Especially, the MoS_2, like the graphene with two-dimensional layered structure, has been widely used in LIBs. However, MoS_2 still faces many challenges in the application of the LIBs, such as the poor electron conductivity, volume expansion, and agglomeration of nanoparticles

In order to overcome the consumption of graphite and the inherent shortcoming of MoS_2 materials, the MoS_2 nanosheets grow vertically on the inside and outside surface of the carbonized corn stalks (MoS_2/CCS) by a simple hydrothermal reaction in the paper,. The vertical grown structure can not only improve transmission rate of Li^+ and electrons but also avoid the agglomeration of the nanosheets. Meanwhile, a new approach of biomass source application is presented. We use CCS instead of graphite power, which can not only avoid the exploitation of graphite resources, but also can be used as a base for MoS_2 growth, and reduce the volume expansion of MoS_2 in the long cycle. As the anode of the lithium-ion batteries (LIBs), MoS_2/CCS shows excellent electrochemical performance. They give initial discharge capacity of 1409.5 mA g^{-1} with of CE of 72.06% at 100 mA g^{-1} and discharge capacity of 1230.9 mAh g^{-1} with 100 % retention after 250 cycles. At the rate of 4000 mA g^{-1}, the discharge capacity reaches to 777.7 mAh g^{-1}. At the same time, the electrode materials show excellent long-term cycling performance, which maintains about 500 mAh g^{-1} at the current density 5000 mA g^{-1} after 1000 cycles.



Scheme 1 Schematic illustration of the procedure for preparing MoS2/CCS composites