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Hard Carbon/SiO_x Composite Active Material Prepared from Phenolic Resin and Rice Husk for Li-ion Battery Negative Electrode

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The composite negative electrode active material of Li-ion batteries (LIBs) was fabricated using phenolic resin (PR) and agricultural waste of rice husk (RH). Because silicates were intrinsically composed in RH, the composite of hard carbon (HC) and SiO_x (HC/SiO_x composite) was readily prepared by carbonizing the mixture of PR and RH. Li-ion insertion and extraction capacity of the HC/SiO_x composite was evaluated in a half-cell configuration using Li metal as the counter electrode, in comparison with those of the carbonized RH and the commercial HC. It was revealed the HC/SiO_x composite exhibited 30% higher specific capacity of Li-ion insertion/extraction than did the commercial HC. In addition to this, its capacity retention was found to be approximately equal to that of the commercial HC. The performance comparison of the HC/SiO_x composite and the carbonized RH suggested that hybridization of HC and SiO_x was useful to alleviate the capacity fading of the SiO_x part with maintaining the increased specific capacity attributed to the SiO_x part. Cost-effective active material for the LIB negative electrode with acceptable performances could be realized by the simple carbonization of the mixture of PR and RH. The produced HC/SiO_x composite was promising for vehicle applications requiring excellent cycle performance and high cost effectiveness.

Keywords : Lithium-ion battery, negative electrode, anode, hard carbon, SiO_x, rice husk