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High-capacity long-cycle life reduced graphene oxide and it's composite with iron fluoride as cathode materials for Na-ion batteries

High-performance rechargeable batteries are urgently required to meet the rapidly increasing demand for energy storage with cost and availability merits. Recently, sodium-ion batteries (SIBs) have emerged as a potential candidate owing to the need for energy storage in large-scale applications such as stationary grid storage. Sodium possesses the advantages of natural abundances, relatively low cost and due to monovalent; its intercalation chemistry into electrode materials resembles lithium. However, the development of cathode materials in SIBs is quite challenging to compete for the lithium-ion batteries (LIBs) as reduction potential of sodium is lower than lithium (-2.71V compared to -3.04V vs. S.H.E.). Herein, we investigate the electrochemical properties of a nanocomposite of FeF3•0.5H2O and reduced graphene oxide as a cathode material for SIBs. Two different cathodes comprising reduced graphene oxide (RGO) and a composite (of RGO and FeF3•0.5H2O) are characterized for SIBs. The RGO electrode delivers an exceptionally stable discharge capacity of 240 mAh g^{-1} with a stable long cycling up to 1000 cycles. The composite's structure, morphology, and microstructure were studied using XRD, SEM, and TEM, respectively. The nanocomposite cathode exhibits a high capacity of 266 mAh g^{-1} in SIBs. The composite also shows a stable cycle performance with a high capacity retention of >86% after 100 cycles. To understand the electrochemical reaction mechanism in the composite electrode, the cells were disassembled at different charged-discharged potentials for ex situ TEM and X-ray absorption spectroscopy and the results confirm the reversibility of reaction.

Speaker Biography

Dr. Kyung Yoon Chung is head and principal researcher of the Center for Energy Convergence Research at Korea Institute of Science and Technology (KIST). He got his Ph.D in materials science in 2003 at Yonsei University, South Korea. Then he worked as a Research Associate at Chemistry Department of Brookhaven National Lab., USA. Since 2006, he is working for the KIST. His research focuses on the electrode materials for the secondary batteries. Currently, he is more focusing on the electrode materials for next generation batteries.

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