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Room Temperature synthesized Graphene/MOPOF Nanocomposites for Low-cost Li Battery Cathodes

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Lithium ion batteries (LIBs) are the best available technology today to push forward the production of eco-friendly electric vehicles (EVs) to reduce the emission of CO_2 into the atmosphere. In addition, they are promising for efficient utilization of renewable energy sources which needs to be stored for usage. The transformation from conventional vehicles run by fossil fuels to battery powered EVs are mainly hindered by the high upfront price of the EVs which is mainly due to the high cost of the battery packs used in these vehicles. Hence, cost reduction of LIBs is one of the major strategies to bring forth the EVs to compete in the market with their gasoline counterparts. Cathode materials account for more than 40% of the total cost of LIBs and hence the cost reduction should primarily focus on alternative low cost cathode materials. In this work, Graphene/ MOPOF (Metal Organophosphate Open Framework) nanocomposites, $G/K_2[(VO)_2(HPO_4)_2(C_2O_4)]$ with ~4 V of operation has been developed by a cost effective room temperature synthesis that eliminates any expensive post-synthetic treatments at high temperature and devoid of inert atmospheres like $Ar/Ar\text{-}H_2$. Though the pristine MOPOF material can undergo reversible lithium storage, it encounter capacity fading due to intrinsic poor conductivity. Enhanced lithium cycling with minimal capacity fading was witnessed with the graphene nanocomposite owing to the increased electronic conductivity and enhanced Li diffusivity. GITT studies to examine the Li ion conduction in the material revealed the good Li ion diffusion coefficients in the framework, which are of the order of some layered oxide cathodes.

References

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