**ABSTRACT**

Potassium-ion batteries (KIBs) are considered as an alternative energy storage device for [lithium-ion batteries](https://www.sciencedirect.com/topics/chemistry/lithium-ion-battery) (LIBs) owing to the low cost and earth abundant. Herein, first time we report the hydrothermally synthesized Bacilli rod shape V2O5 and making composite with reduced [graphene oxide](https://www.sciencedirect.com/topics/chemistry/graphene-oxide) (rGO) for KIBs which greatly boosting the cycle durability and rate capability. Sheet-like materials (rGO) greatly enhance the performance of energy storage materials due to their high surface area which largely improves the [electrochemical reaction](https://www.sciencedirect.com/topics/chemistry/electrochemical-reaction) kinetics. The heterostructure of V2O5 [nanorods](https://www.sciencedirect.com/topics/chemistry/nanorod) anchored on highly conductive rGO matrix not only enhance the reaction kinetics but also offer a more reactive surface area for potassium-ion storage resulting superior cycling stability. The V2O5@rGO exhibits a reversible capacity of 271 mAhg−1 and retains 80% initial discharge capacity after 500 cycles. It shows excellent rate capability and delivers 50 mAhg−1 even at the high current density of 2940 mAg−1 (10C). Ex-situ TEM and XRD analysis confirmed that the rod-shape with sheet like rGO morphology is retained after 500 cycles. The design of nanorod@sheet like architecture becomes a promising cathode candidate for high performance KIBs