**ABSTRACT**

A simple one-step [hydrothermal method](https://www.sciencedirect.com/topics/chemistry/hydrothermal-method) is used for the fabrication of MnCO3 nanorods@rGO composite without any further heat treatment. MnCO3 [nanorods](https://www.sciencedirect.com/topics/chemistry/nanorod) with size of ~5–10 nm in diameter are anchored well on the surface of rGO sheets. The sheet-like nature of rGO is well maintained in the composites. The MnCO3 nanorods@rGO composite provides high surface area (122.6 m2 g−1) for conversion reaction and delivers high capacity and superior long-term cycling performance for potassium-ion batteries. The composite delivers a high capacity of 841 mAhg−1 and retains 88% capacity at the current density of 200 mAg−1 after 500 cycles. Even at the high current density of 2000 mAg−1, the material still delivers a stable capacity 98 mAhg−1 and maintains over in subsequent cycles. From the ex-situ TEM analysis, we confirmed that the morphology and structure of the composite is preserved after 500 cycles. This further confirms that rod-like morphology on rGO sheets acts as a stable template for reversible [potassium](https://www.sciencedirect.com/topics/physics-and-astronomy/potassium) intercalation/deintercalation. Moreover, rGO sheets accommodate the volume expansion during cycling and provide structural stability for MnCO3 nanorods