Heterostructures Assembled from Bi2O2CO3 and MXene for Boosted Potassium-Ion Storage by Arousing the Built-in Electric Field

Song Chen¹, Heping Ma¹, Yibo Du¹, Zhitao Wang¹, Shuang Fan¹, Wenming Zhang¹, and Hui Ying Yang¹

¹Singapore University of Technology and Design

November 13, 2023

Abstract

Bismuth-based materials have been recognized as the appealing anodes for potassium-ion batteries (PIBs) due to their high theoretical capacity. However, the kinetics sluggishness and capacity decline induced by the structure distortion predominately retard their further development. Here, a heterostructure of polyaniline intercalated Bi2O2CO3/MXene (BOC-PA/MXene) hybrids has been reported via simple self assembly strategy. The ingenious design of heterointerface-rich architecture motivates significantly the interior self-built-in electric field (IEF) and high-density electron flow, thus accelerating the charge transfer and boosting ion diffusion. As a result, the hybrids realize a high reversible specific capacity, satisfying rate capability as well as long-term cycling stability. The in/ex-situ characterizations further elucidate the stepwise intercalation-conversion-alloying reaction mechanism of BOC-PA/MXene. More encouragingly, the full cell investigation further highlight its competitive merits for practical application in further PIBs. Our present work not only opens the way to the design of other electrodes with an appropriate working mechanism but also offers inspiration for built-in electric-field engineering toward high-performance energy storage devices.

Hosted file