

TiS₂ as a High Performance Potassium Ion Battery Cathode in Ether-based Electrolyte

Liping Wang, Jingyi Yang, Jian Zou, Cheng Jiang, Zhenrui Wu, Jie Li
State Key Laboratory of Electronic Thin Films and Integrated Devices, University of
Electronic Science and Technology of China, Chengdu 610054, China
E-mail: lipingwang@uestc.edu.cn

Potassium ion batteries are potential energy storage devices owing to their low cost and good K⁺ diffusion kinetics due to the small Stoke's radius [1-2]. Here, we report a layered TiS₂ cathode material, demonstrating outstanding potassium storage cycling and rate performances in ether-based electrolyte, with a capacity of 80 mAh g⁻¹ at 20 C and 63 mAh g⁻¹ after 600 cycles (1.5-3.0 V, corresponding to 4.8 A g⁻¹). The phase transitions during K ion intercalation at the atomic level are explored via High Resolution Transmission Electron Microscopy (HRTEM) and *ex-situ* X-ray diffraction (XRD) combined with Rietveld refinements. It undergoes a second-stage structure to be K_{0.11}TiS₂ and then first-stage K_{0.56}TiS₂. The K cations intercalate into trigonal prismatic sites with a sliding of Ti-S plane by 120 degree-rotation, rendering a $\sqrt{3} \times \sqrt{3}$ commensurate superstructure along the [001] zone. The K stage intercalation is in favor of a Daumas-Hérolde model rather than Rüdorff model. This study demonstrates that the layer structure materials are promising candidates for high performances K-ion batteries and highlights the importance of improving electrochemical performances with electrolyte modification.

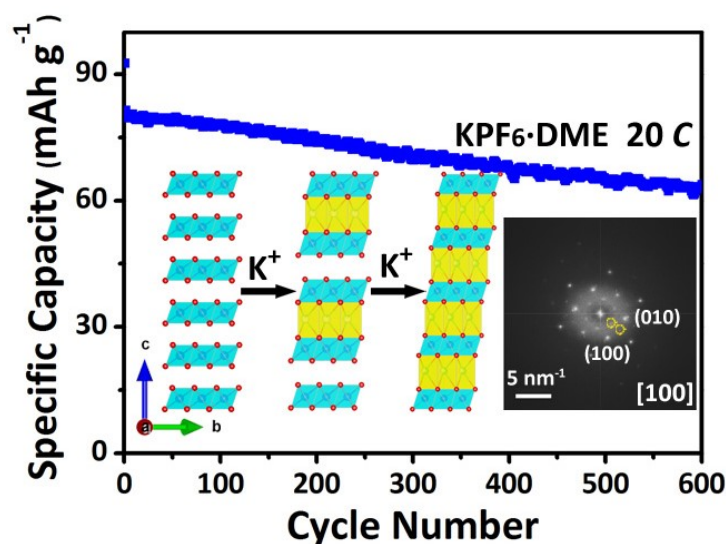


Fig. 1. Electrochemical performance and phase transitions of TiS₂ as K-ion battery cathodes.

References:

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