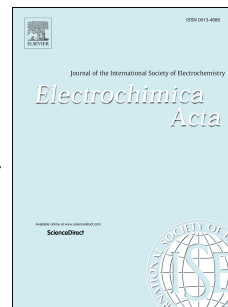


# Accepted Manuscript

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# Freestanding 3D Single-wall Carbon Nanotubes/WS<sub>2</sub> Nanosheets Foams as Ultra-Long-Life Anodes for Rechargeable Lithium Ion Batteries

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## Abstract

Tungsten disulfide (WS<sub>2</sub>) have been attracting increasing attention as anode materials for high performance lithium-ion batteries (LIBs) due to their high theoretical capacity and large interlayer spacing. However, the low conductivity and volume expansion during lithiation/delithiation process will lead to the low specific capacity and rapid capacity fading during long-term cycling. Here, we have used flexible single-wall carbon nanotubes (SWCNTs) with ultra-high electrical conductivity as conductive materials to construct a three-dimensional (3D) WS<sub>2</sub>@SWCNT foam by a simple hydrothermal method followed by freeze-drying process. The 3D structure not only provide good electronic transportation pathways, but also can accommodate huge volume change of WS<sub>2</sub> due to the mechanical flexibility of SWCNTs, leading to the excellent cyclability as anode materials for LIBs. Benefiting from these excellent properties, the WS<sub>2</sub>@SWCNT foam nanostructure delivers a specific capacity of 1050 mAh g<sup>-1</sup> at a current density of 0.1 A g<sup>-1</sup>, high reversible capacity of 688.3 mAh g<sup>-1</sup> after 1000 cycles and a capacity retention of 113% over 1000 cycles at 1 A g<sup>-1</sup>.

**Keywords:** carbon nanotube, graphene, lithium ion battery, cycle stability, three-dimensional structure

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