All-Purpose Electrode Design of Flexible Conductive Scaffold toward High-Permanence Li-S Batteries

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The main obstacles that hinder the development of efficient lithium sulfur (Li-S) battery are the polysulfide shuttling effect in sulfur cathode and the uncontrollable growth of dendritic Li in the anode. Herein, we report an all-purpose flexible electrode that can be served both in sulfur cathode and Li metal anode, and meanwhile the application in wearable and portable storage electronic devices is discussed. The flexible electrode consists of a bimetallic CoNi nanoparticles embedded porous conductive scaffold with multiple Co/Ni-N active sites (CoNi@PNCFs). Both experimental and theoretical analysis show that, when used as the cathode, the CoNi and Co/Ni-N active sites implanted on the porous CoNi@PNCFs significantly promot the chemical immobilization towards soluble lithium polysulfides and its rapid conversion into insoluble Li_2S, and therefore effectively mitigates polysulfide shuttling effect. Meanwhile, the 3D matrix constructed with porous carbonous skeleton and multiple active centers successfully induce homogenous Li growth, realizing a dendrite-free Li metal anode. The Li-S battery, assembled with S/CoNi@PNCFs cathode and Li/CoNi@PNCFs anode, achieve a high reversible specific capacity of 785 mAh g^{-1} and long cycle performance at 5 C (capacity fading rate of 0.016 % over 1500 cycles).