Sulfur cathodes with tetrapod TiO_2 nanoparticles for lithium sulfur batteries

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Lithium sulfur batteries (LSBs) are known as potential high energy storage devices due to their excellent energy density. However, research on lithium-sulfur cells with high energy density per volume is less attention. We fabricate tetrapod particles by a facile approach of crushing 3D ordered macropore structures. Tetrapod TiO2 particles achieve high density assembly by high contact between particles, and at the same time enhance the adsorption and catalytic reaction of lithium polysulfide ions, resulting in a superior kinetics LSBs. Tetrapod TiO2/S cells show high volumetric capacity due to their high tap density, and a volumetric capacity of 894.5 mAh/cm3, which is more than six times higher than that of commercial TiO2/S cells, is obtained. In particular, high tap density electrodes enable the use of small volume electrolytes and exhibit a capacity retention of 77.2% even under the 'lean electrolyte' condition, which is one third of the normal electrolyte volume.