Facile Synthesis of Hierarchical Porous Titanium Nitride by Multiscale Phase Separation

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Porous architectures are critical to determine the electrochemical performance of lithium–sulfur batteries (LSBs). Especially, multiscale porous architecutures are highly required to tackle the limitations of single-sized porous architectures, and to combine the advantages of different pore scales. Even though a few carbonaceous materials with multiscale porosity are introduced in LSBs, their nonpolar surface properties lead to the severe dissolution of lithium polysulfides (LiPSs). In this context, multiscale porous structure design of noncarbonaceous materials is highly needed, but has not been explored in LSBs yet due to the absence of a simple method to control the multiscale porous inorganic materials. Herein, a hierarchically porous titanium nitride (h-TiN) is reported as a multifunctional sulfur host, combining the advantages of multiscale porous architectures with intrinsic surface properties of TiN to achieve high-rate and long-life LSBs.