Hierarchically porous N-doped C nanofibers comprising metal nitride quantum dots and metal-organic framework-derived hollow N-doped C nanocages as a freestanding interlayer for advanced lithium-sulfur batteries

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Development of advanced Lithium-sulfur batteries with practically feasible parameters such as high sulfur content, high active material loading, and low electrolyte volume is highly challenging owing to the various fundamental problems. In this regard, the incorporation of functional interlayers as a modified cell component gains worldwide attention. The hybrid interlayers not only act as a reservoir for efficient polysulfide absorption but also enhances the sulfur cathode integrity especially at high loadings. In this work, we utilize a hierarchically developed multifunctional, porous, and freestanding interlayer using conventional electrospinning technique followed by one step heat treatment process. The Lithium-sulfur cell assembled using freestanding interlayer, high sulfur content electrode with high sulfur loading, and low electrolyte volume results in enhanced electrochemical performance with high-rate capability and stable prolonged cycling owing to the efficient anchoring of lithium polysulfides. The novel nanostructured strategy may provide sufficient knowledge to overcome the major practical barriers for the development of feasible Lithium-sulfur batteries.