Tuning the charging reaction protocol for advanced anode-less lithium-metal battery

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Lithium metal has been well throughout as a significant anode material to further escalate the energy density of lithium ion batteries(LIBs) due to its high theoretical specific capacity (3860 mAh g^{-1}). In addition, to achieve a higher energy density with minimal production cost, advanced battery configuration towards the anode-less lithium metal battery (AL-LMB) which does not utilize the premounted Li source in anode, but uses the Li^{+} extracted from the cathode. However, a fatal electrolyte decomposition and severe dendritic growth of Li in AL-LMB were regarded as a critical obstacles to realize the practicable AL-LMB. From this techno-economical understanding, here, we present 3D carbon current collector coated with defective carbon layer which fundamentally changes the charging reaction protocol leading a less electrolyte decomposition and subsequently uniform Li deposition. As a result, AL-LMB exhibits extraordinary high coulombic efficiency of 98% with long cycle life at the current density of 2 mA cm^{-2} and 5 mAh cm^{-2} areal capacity. To the best of our knowledge, this performance of AL-LMB shows higher cyclic stability and coulombic efficiency than reported for other AL-LMBs.