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Abstract

Metal-organic framework (MOF) glasses have recently attracted increasing attention as promising anode materials for lithium-ion batteries (LIBs) due to their multiple advantages of open network structures, large surface area, and abundant reaction sites. However, the reversible capacities of MOF glasses still need to be improved to match the rapid development of green energy technologies. Silicon is a promising candidate for the next generation of LIB anode but suffers from vast volume changes upon lithiation/delithiation. Here, we present a strategy to *in situ* grow a kind of MOF, namely, cobalt-ZIF-62 ($Co(imidazole)_{1.75}(benzimidazole)_{0.25}$) on the surface of Si nano particles, and then to transform the thus-derived material into Si@ZIF-glass composite (SiZGC) through melt-quenching. The robust hierarchical structure of the SiZGC based anode exhibits the specific capacity of ~650 mA h g^{-1}, which is about three times that of pure ZIF glass and about six times that of pristine ZIF crystal at 1 A g^{-1} after 500 cycles. The origin of this huge enhancement is revealed by performing structural analyses. The unique structure of ZIF glass can not only enhance lithium storage, but also buffer the volume changes and prevent the aggregation of Si nano particles during lithiation/delithiation processes.

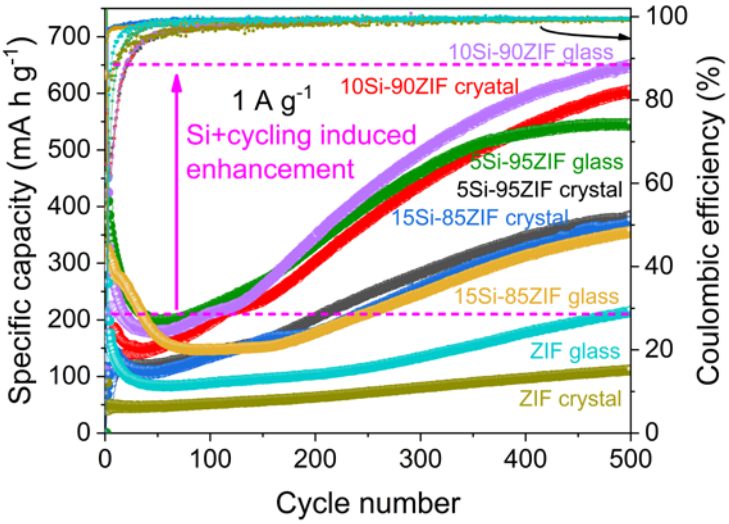

Figure 1. *The cycling performance of the anodes made from ZIF crystal/glass, 5Si-95ZIF crystal/glass, 10Si-90ZIF crystal/glass, 15Si-85ZIF crystal/glass at 1 A g^{-1}.*

References

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