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Controllable synthesis of 2D Cr-doped $MoO_{2.5}(OH)_{0.5}$ nanosheets and application in Lithium Ion Batteries

Abstract： α-MoO_3 has gained growing attention as anode matreials for lithium-ion batteries (LIBs) due to its high theoretical capacity (1111 mAh g^{-1}). However, their key limitations are its low electronic conductivity and limited structural stability during charge-discharge process. Herein, we report a new 2D layered Cr-doped $MoO_{2.5}(OH)_{0.5}$ (doped $MoO_{2.5}(OH)_{0.5}$), existing good electrical conductivity and fast Li^+ diffusion pathways for high-performance LIBs by a unique "doping-adsorption" strategy. Compared with doped MoO_3, doped $MoO_{2.5}(OH)_{0.5}$ has larger expanded spacing of the (0*l*0) crystal crystal plane for ultrafast Li^+ storage. Their lithiation-delithiation processes were studied by *ex situ* TEM combined with XPS analysis to reveal the mechanism of the reversible conversion reaction. Interestingly, for doped $MoO_{2.5}(OH)_{0.5}$, it was found through the as-formed Li_xMoO_3 had an expanded (040) crystal plane with well-dispersed nano-dots after 10 cycles. Moreover, the pulverized electrode has a distinct open pore structure. This unique structural characterization would increase the effective surface of intermediate products Li_xMoO_3 to react with Li^+ and shorten the diffusion path to prompt electrochemical reaction. Additionally, the presence of Cr also played an important role in the reversible decomposition of Li_2O and enhanced specific capacity. When employed as an anode in NIBs, doped $MoO_{2.5}(OH)_{0.5}$ delivers a capacity of 294 mAh g^{-1} at 10 A g^{-1} after 2000 cycles. Moreover, the reversible capacity after electrochemical activation, is quite stable throughout the cycling, thereby presenting a promising new anode materials for Li^+ storage.

References

[1] C. Wang , L. Wu , H. Wang , W. Zuo , Y. Li , J. Liu, Adv. Funct. Mater., 25 (2015) 3524-3533.
[2] L. Cao, J. He, J. Li, J. Yan, J. Huang, Y. Qi, L. Feng, J. Power Sources, 392 (2017) 87-93.

Figures

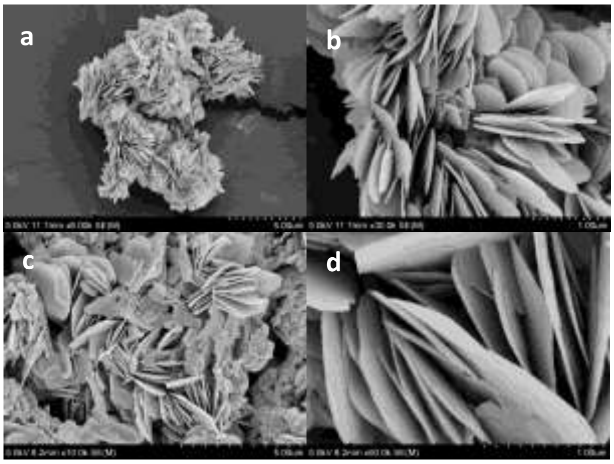

Figure 1: (a)-(b) FESEM images of 2D Cr-doped $MoO_{2.5}(OH)_{0.5}$ and (c)-(d) 2D Cr-doped MoO_3.

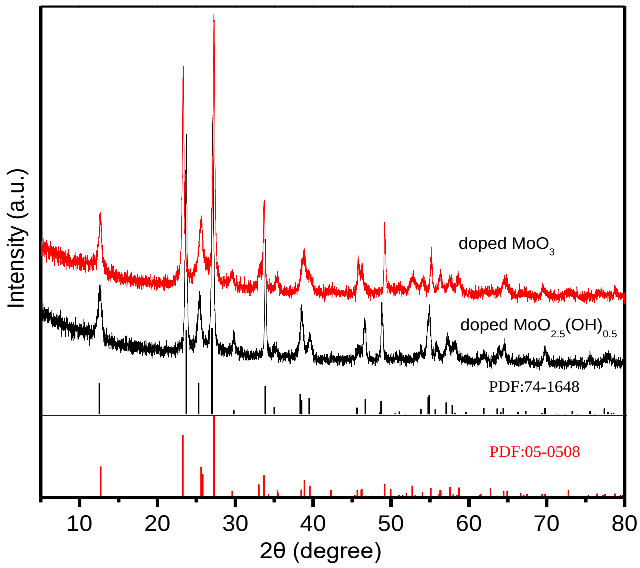

Figure 2: XRD patterns of doped MoO_3 and doped $MoO_{2.5}(OH)_{0.5}$.

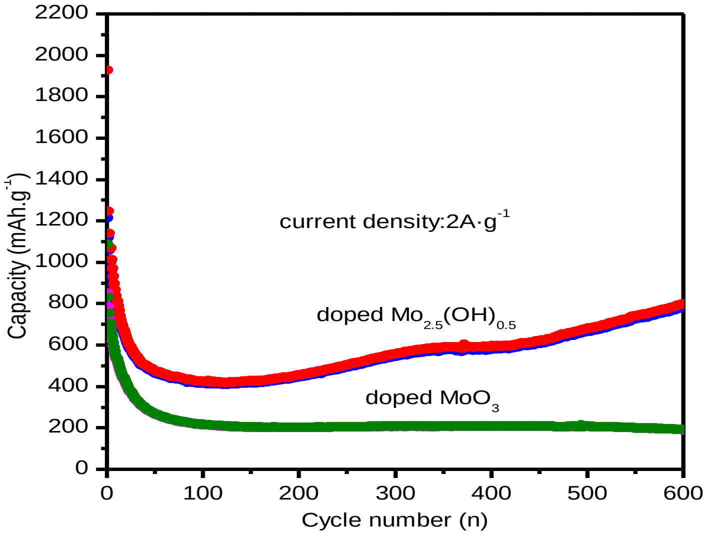

Figure 3: Cycling performances of doped MoO_3 and doped $MoO_{2.5}(OH)_{0.5}$ at 2A g^{-1}.