Enhanced Oxygen Vacancies in Nanostructured LiNi$_{0.5}$Mn$_{1.5}$O$_{4-\delta}$ with a P4$_3$32 Space Group

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LiNi$_{0.5}$Mn$_{1.5}$O$_{4-\delta}$ microspheres with a P4$_3$32 space group constructed from nanometer-sized primary particles are synthesized using an ammonia-mediated carbonate precipitation method. Rietveld refinement of XRD and XPS results reveal that the total number of oxygen vacancies increases with increasing synthesis time. Li/Ni antisite defects increase with the synthesis time. The 5th discharge capacity of the sample synthesized at 700 °C for 10 h reaches 142.9 mAh g$^{-1}$ at a discharge rate of 0.1 C. The discharge capacity at a discharge rate of 0.5 C is still above 120 mAh g$^{-1}$. When the current is increased from 0.2 C to 0.5 C, the percentage of the capacity loss increases sharply with increasing synthesis time. We suggest that this is closely related to the higher number of oxygen vacancies, increasing Li/Ni antisite defects and bigger primary particles.

Keywords: LiNi$_{0.5}$Mn$_{1.5}$O$_{4-\delta}$, P4$_3$32 space group, nano-structured, oxygen vacancies, Li/Ni antisite defects

FULL TEXT

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