

Electrochemical characteristics of Co-doped Li_5AlO_4 as novel cathode active material with high capacity density

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Summary

Co-doped Li_2O has been investigated as cathode active material with high capacity density¹. However, the material has lower reversible capacity density (more than 200 mAh g^{-1}) than its theoretical capacity density (556 mAh g^{-1}) because a charge reaction and decomposition reaction occur simultaneously during its charge process. In this report, Co-doped α and β - Li_5AlO_4 as solid solution of Li_2O and LiAlO_2 are investigated for inhibiting decomposition reactions.

Methods

Co-doped α and β - Li_5AlO_4 samples were synthesized by mechanical milling of various amount of α , β - Li_5AlO_4 , and LiCoO_2 in an argon atmosphere using 10 WC balls (10 ϕ) and pod with 600rpm of rotation frequency through 2 hours and calcinated at 750 and 950°C in N_2 and O_2 mixed gas (volume ratio 8:2) flow through 50 hours. X-ray diffraction (XRD) patterns of $\text{Li}_{(5-x)}\text{Co}_x\text{AlO}_4$ samples were measured using monochromatized $\text{Cu-K}\alpha_1$ radiation on a Rigaku Ultima IV. The diffraction patterns were analyzed by Rietveld method using RIETAN-FP program².

Major results and conclusion

Fig. 1(a) shows XRD patterns of as-prepared and Co-doped β - Li_5AlO_4 samples. Peaks observed in both XRD patterns of as-prepared β - Li_5AlO_4 and Co-doped β - Li_5AlO_4 (molecular ratio LiCoO_2/β - Li_5AlO_4 is 0.1) were attributed to β - Li_5AlO_4 . Fig. 1(b) shows XRD patterns of as-prepared and Co doped α - Li_5AlO_4 samples. Peaks observed in XRD patterns of Co-doped α - Li_5AlO_4 (molecular ratio LiCoO_2/α - Li_5AlO_4 is 0.5 and 1.0) were attributed to α - Li_5AlO_4 and LiCoO_2 . As a result of RIETVELD analysis, it was turned out that Co-doped β - Li_5AlO_4 was not substituted by Co and α - Li_5AlO_4 phase in Co-doped α - Li_5AlO_4 was substituted by Co. From these results, it was suggested that substitutable amount of heteroelements in Li_5AlO_4 was determined by crystal structure.

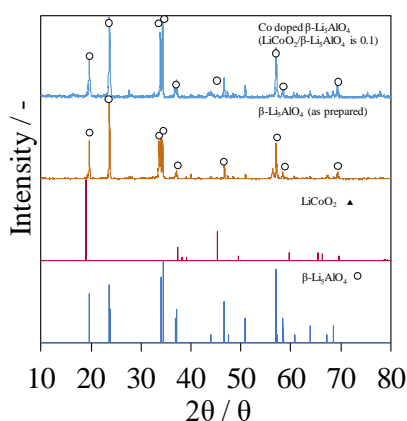


Fig. 1(a) XRD patterns of as-prepared β - Li_5AlO_4 and Co-doped β - Li_5AlO_4

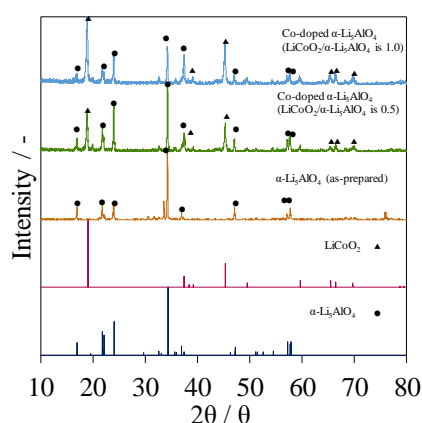


Fig. 1(b) XRD patterns of as-prepared α - Li_5AlO_4 and Co-doped α - Li_5AlO_4 .

Reference

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