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Overcoming Jahn-Teller distortion for spinel Mn phase
스피넬 망간상에서 Jahn-Teller distortion 해결

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1. Introduction

$Li_xMn_2O_4$ (x=1) has a cubic spinel structure with space group symmetry *Fd3m*. For $1 \leq x \leq 2$, the lithium insertion into $LiMn_2O_4$ results in the transition of the structure from cubic into tetragonal $Li_2Mn_2O_4$, which is accompanied by the Jahn-Teller distortion. Here we report the synthesis and electrochemical performance of a new sulfur-doped spinel material, $LiAl_{0.24}Mn_{1.76}O_{3.96}S_{0.4}$, which overcomes the Jahn-Teller distortion.

2. Experimental

$LiAl_{0.24}Mn_{1.76}O_{3.98}S_{0.02}$ powders were prepared by a sol-gel method using glycolic acid as a chelating agent according. Transmission electron microscope (TEM) and selected area electron diffraction pattern (SADP) of the individual oxide particles in the powders and cycled electrodes were used to investigate the structural integrity of the oxysulfide spinel host.

3. Results and Discussion

Our synthesized material overcomes the Jahn-Teller distortion in all the operating voltage regions. The material shows the capacities of 103, 128, and 230 mAh/g in the 4 V, 3 V, and both the 3 and 4 V regions, respectively, with excellent cyclability. The selected area electron diffraction pattern (SADP) of the lattice image also exhibits unequivocal evidence of the cubic spinel phase. Further TEM investigations showed the same patterns in the as-prepared powders and electrodes cycled in the 3 V and 4 V region.