PHYSICAL, SPECTRAL AND ELECTROCHEMICAL BEHAVIOR OF CoV_2O_5 SYNTHESIZED BY SOFT COMBUSTION TECHNIQUE FOR USE IN LITHIUM RECHARGEABLE CELLS

Yong Top Kim, S. Gopukumar, K.B. Kim
Division of Materials Science and Engineering, Yonsei University, 134 Sinchon-dong, Saedemoun-gu, 120-749 Seoul, South Korea.

Introduction

Vanadium oxides are attractive due to their high lithium storage capabilities and thereby offering very high capacities of ~250 to 300mAh/g.[1] However, the use of pristine V_2O_5 in lithium secondary batteries leads to capacity fading[2] on extended cycling. Hence, attempts to enhance the performance of pristine V_2O_5 either by incorporation of metal ions (Co, Ni, Mn, Na, Cu and Ag) or by tuning the synthesis method, are being pursued. We recently reported, a novel route for the synthesis of cobalt incorporated vanadium oxide i.e., CoV_2O_5.[3] In this communication, we present the structural (Raman, FTIR, XPS), morphological (SEM) as well as electrochemical behavior of the hitherto synthesized CoV_2O_5 using glycine assisted sol-gel combustion technique.

Experimental

CoV_2O_5 powder has been synthesized as reported previously[3]. The synthesized CoV_2O_5 powder was analyzed using micro-Raman, XPS and FTIR spectroscopy. Surface morphology was observed using SEM micrograph. Electrochemical measurements were performed using a three electrodes glass cell with Li as counter and reference electrode. The working electrode consisted of CoV_2O_5, AB and PVDF in NMP and coated on to an Al foil, dried at 90℃ for 2 hours and then cycled in the potential range 2-4V in 1M $LiClO_4$/PC as electrolyte solution.

Results and Discussion

TG/DTA studies performed on the gel precursor obtained at 140℃ indicated the formation of CoV_2O_5 at low temperatures. The Raman spectra (Fig.1) of CoV_2O_5 show that the synthesized material is amorphous. Surface morphological studies (Fig.2) on the synthesized CoV_2O_5 indicated the spherical Co atoms in the rod shaped V_2O_5 materials. XPS spectra of CoV_2O_5 are presented in Fig3 and clearly depicts that the oxidation state of Co and V are +2 and +5, respectively thereby confirming the formation of CoV_2O_5. Further, charge/discharge cycling studies reveal that the synthesized CoV_2O_5 delivers a capacity of ~275mAh/g and can be cycled without fading.

Conclusion

SEM, Raman, FTIR and XPS results confirm the synthesis of CoV_2O_5 by low temperature glycine assisted sol-gel technique. Further, this simple and novel technique demonstrates a stable capacities of ~ 275mAh/g.

References

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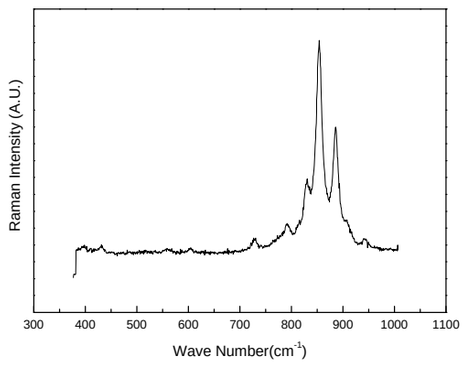


Fig. 1 Micro Raman Spectra of CoV_2O_5

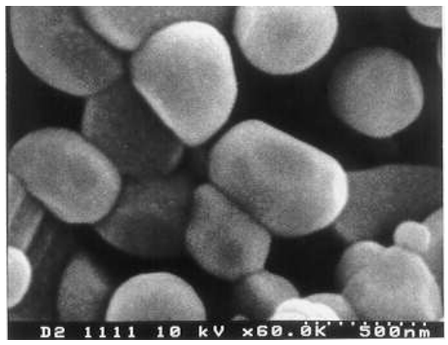
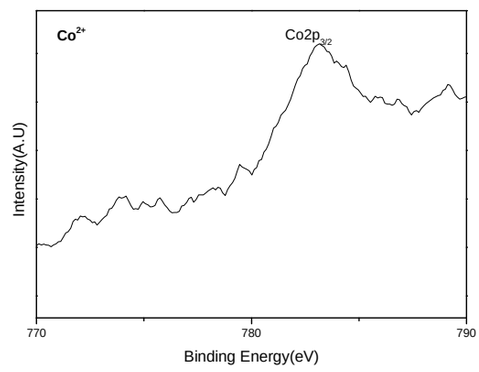


Fig. 2. Morphology of CoV_2O_5



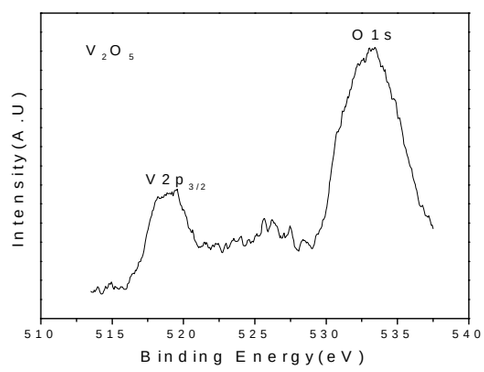


Fig. 3. XPS Spectra of CoV_2O_5