

Electrochemical performance and XPS surface analyses of HE-NCM/LTO cells in (LP30 vs. IL) electrolytes

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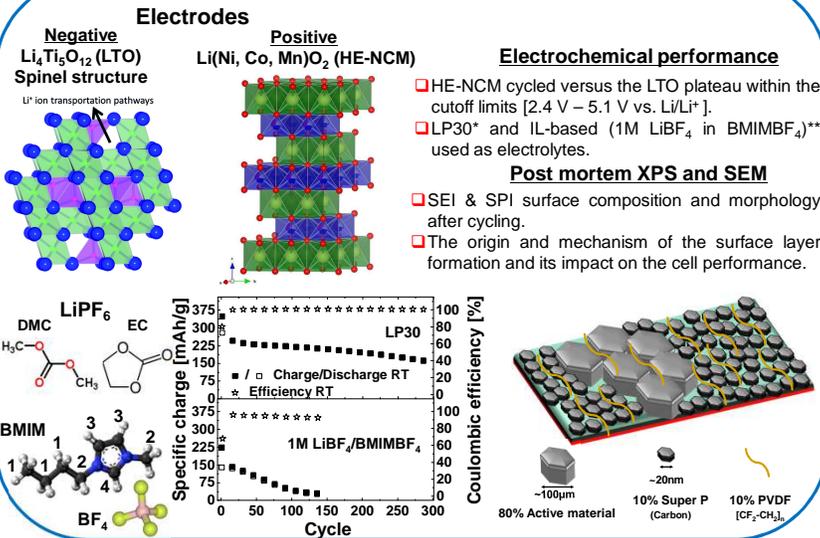
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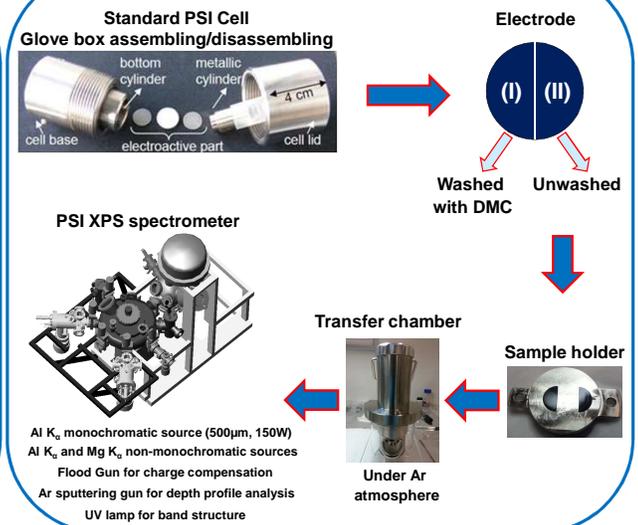
Introduction

The instability of (electrode/electrolyte interface) at high temperatures (> 50° C) and potentials (> 4.5 V) of the most common carbonate-based electrolytes is limiting the development of the next generation of high specific energy Li-ion batteries.[1] However, these problems can mainly be overcome by the use of ionic liquids (ILs) as alternative electrolyte solution. Their physical properties such as thermal (> 120° C)/electrochemical (> 5.5 V) stability and low vapor pressure make them a promising electrolytes.[2]

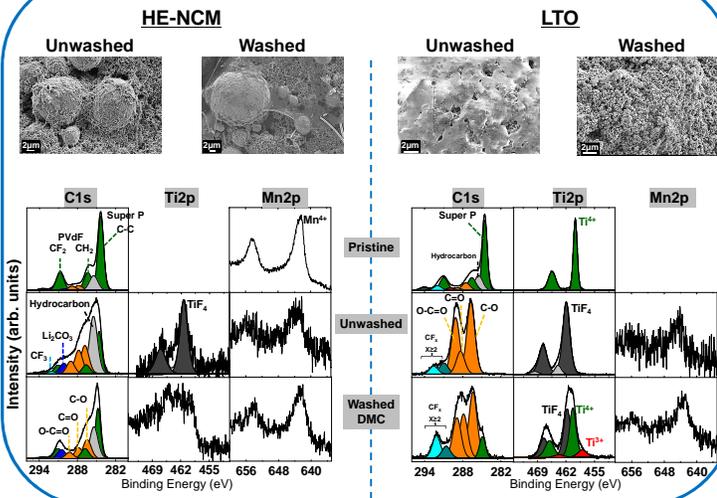
Objective



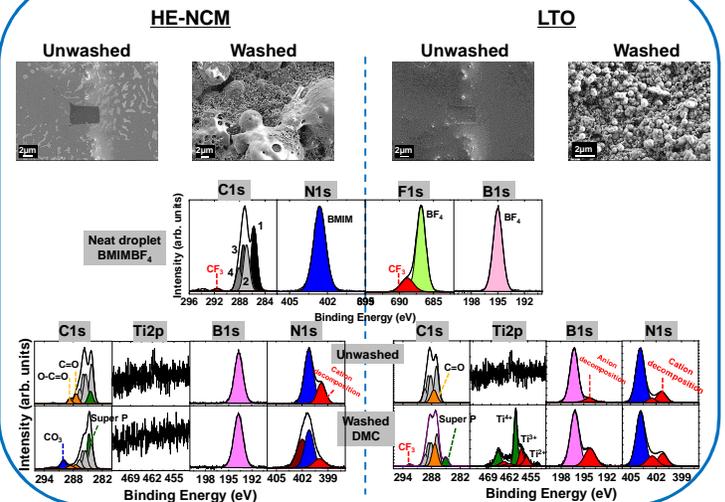
Post mortem XPS – Process flow



Cycled with LP30*



Cycled with BMIMBF₄**



Conclusions

- Good electrochemical cycling was demonstrated with LP30, however with the IL 36% less specific charge was obtained with continuous fading up to 30 mAh/g after 130 cycles
 - Important impact of the washing was observed on the surface composition mainly on LTO surface
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|--|---|
| <p>With LP30</p> <ul style="list-style-type: none"> Formation of thick surface layer on LTO however is less pronounced on HE-NCM. Detection of TiF_x species on both electrodes related to the Ti corrosion of the cell. Detection of Mn and Co on LTO due to the transition metal dissolution in the electrolyte. | <p>With BMIMBF₄</p> <ul style="list-style-type: none"> After washing agglomeration of the IL on the active particles. Detection of IL decomposition product on both electrodes No detection of Ti on positive or Mn on negative electrodes |
|--|---|

References

- * 1M LiPF₆ with ethylene carbonate and dimethyl carbonate (EC:DMC 1:1)
 - ** C₈H₁₅BF₄N₂, Cation: 1-Butyl-3-methylimidazolium, Anion: Tetrafluoroborate
 - [1] John B. Goodenough, Rechargeable batteries: challenges old and new, *J. Solid State Electrochem.* 2012 16 2019-2029.
 - [2] M. Armand, F. Endres, D. R. MacFarlane, H. Ohno, B. Scrosati, Ionic-liquid materials for the electrochemical challenges of the future, *Nature Materials*, 2009 8 621-629.
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