Interactions of cation disordered rocksalt cathodes with various electrolytes.

Jan-Paul Brinkmanna, Niloofar Ehteshami-Flammerb, Mingzeng Luoc, Marco Leißingb, Stephan Röserb,d, Sascha Nowakb, Yong Yangc, Martin Wintera,b, Jie Lie

a Helmholtz-Institute Münster, IEK-12, Forschungszentrum Jülich GmbH, Corrensstraße 46, 48149 Münster, Germany

b University of Münster, MEET Battery Research Center, Institute of Physical Chemistry, Corrensstraße 46, 48149 Münster, Germany

c State Key Laboratory of Physical Chemistry of Solid Surfaces, Department of Chemistry, College of Chemistry and Chemical Engineering, Xiamen University, 361005 Xiamen, P.R. China

d E-Lyte Innovations GmbH, Mendelstraße 11, 48149 Münster, Germany

e Department of Energy, Politecnico di Milano, Via Lambruschini 4, 20156 Milano, Italy

Cation disordered rocksalt (DRX) cathode materials have gathered increased research interest over the last couple of years due to their high specific capacity and wide array of transition metal combinations that are not limited to Ni, Co and Mn, despite their lack of a layered structure.(*1-3*) Many of them involve the combination of a redox inactive d0 stabilizing element like Nb.(*4, 5*) The utilization of anionic redox reaction in this material class is believed to be the cause of the materials poor electrochemical performance while possible other factors like unfavorable side reactions with commonly used carbonate-based electrolytes or other cell components are less investigated.(*6, 7*)

In order to address this fact, the electrochemical performance as well as the formation of the cathode electrolyte interphase (CEI) of a Li1.25Fe0.5Nb0.25O2 DRX cathode was investigated in Lithium metal and Lithium ion cells. Thereby, the use of a carbonate-based electrolyte and an ionic liquid-based electrolyte were compared. Severe side reactions occur between the cathode material and the carbonate-based electrolyte which leads to a strong capacity fading and poor Coulombic efficiency. An ongoing decomposition of electrolyte components on the cathode materials surface during charge and discharge cycling covers the material with degradation products like Li2CO3 and LiF which causes resistance growth and is accompanied by dangerous gassing in the cells. The ionic liquid electrolyte on the other hand, shows only negligible degradation and can promote capacity retention.(*8*)

The mismatch of carbonate based electrolytes with the Li1.25Fe0.5Nb0.25O2 cathode shown here can be applied to other DRX materials and open new approaches for improvements in their performance.(*8*)

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