Influence of electrolyte additives on the gassing behaviour in silicon based lithium-ion batteries

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The lithium-ion battery is constantly facing new challenges due to its wide range of uses in mobile and stationary applications. The desire for higher lifetimes as well as larger capacities is becoming more important. To achieve these improvements, a lot of research has gone into optimising the battery components, such as the negative and positive electrode material, as well as electrolytes and their components such as solvents and additives.
However, the more complex combination of components of the battery also lead to more complex chemical processes and side reactions. In particular, the stability of the electrolyte is an important point for a long service life and safety of the battery.
The generation of gases during charging and discharging cycles indicates the degradation of the electrolyte, which can lead to a decrease in usable capacity.
With precise knowledge of the gases produced, valuable indication of the degradation reactions taking place in the cell can be determined.

This contribution shows the influences of the electrolyte additives on the gas generation during the formation and the first cycles of NMC622//graphite-silicon composite coin cells with 5 wt-% each of 3-(Triethoxysilyl)propionitrile (TEOSCN), vinylene carbonate (VC) and fluoroethylene carbonate (FEC) as electrolyte additives. The resulting gases were analysed by GC-MS.

The results of the gas analysis indicate that the use of electrolyte additives has a strong influence on the share of gases in the gas phase of the battery. The corresponding changes in the gas share allow conclusions to be drawn about changed reaction processes, including the formation of the SEI.