SELECTING CELL COMPONENTS WITH LOW CATHODIC ELECTROLYTE REACTIVITY FOR LITHIUM-ION CELLS

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Although inactive materials are widely used as current collectors and other lithium-ion battery (LIB) cell components, a comprehensive study of electrolyte reactivity on inactive material surfaces is lacking [1,2]. An excellent inactive material for LIB negative electrode current collectors should have low initial irreversible capacity, low long-term electrolyte reactivity, and low impedance. In a previous study, we found that copper has 2.5 times higher electrolyte reactivity than graphite when a vinylene carbonate (VC)-containing electrolyte was used [3]. Therefore, Cu is not a good choice at the negative electrode as it can contribute to cell fade. The choice of less reactive materials may improve LIB lifetime.

In this study, electrolyte reactivity on various inactive materials was measured precisely using inactive material/graphite electrodes in double half-cells (DHCs) [3]. This resulted in a high surface area of inactive material being exposed to electrolyte, allowing for precise coulometric analysis of the reactivity of inactive materials.

The irreversible capacity, coulombic efficiency and impedance growth on Cu, Fe, Ni, 304 stainless steel (SS), Mo, Ti, and TiN were investigated. Figure 1 shows the cycling performance of DHCs containing these materials. Here fade is directly related to the electrolyte reactivity of each metal. Significant differences between these metals were found. Many metals have a relatively low electrolyte reactivity. However, Ni and Cu have a high electrolyte reactivity in VC containing electrolyte. This highlights that commonly used inactive materials, such as Cu (current collector) and Ni (tabs), at the negative electrode can contribute to cell fade and that superior alternatives exist. These findings could have significant implications for the design of LIBs with long cycle life.

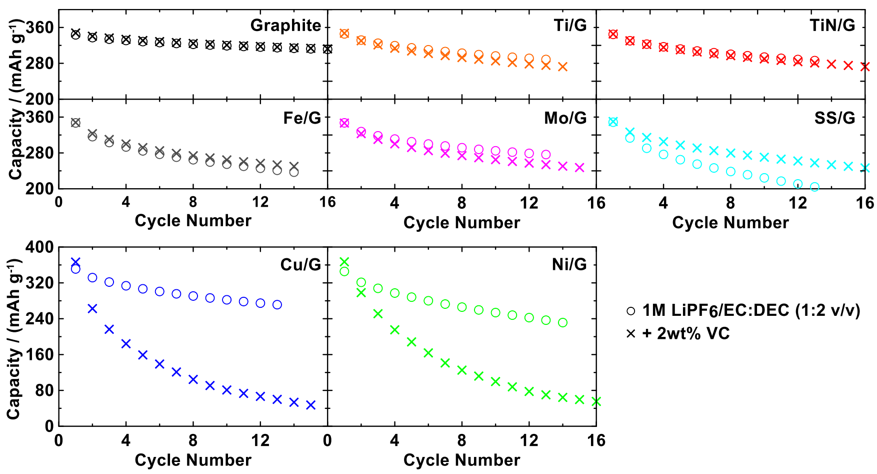

Figure 1 Capacity versus cycle number of graphite and inactive material/graphite DHCs.

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