

Suppression of Cobalt Dissolution from the LiCoO₂ Cathodes by Metal-Oxide Coating

Yong Jeong Kim,¹ Jaephil Cho,^{2,*}
Tae-Joon Kim,¹ and Byungwoo Park^{1,**}

¹School of Materials Science and Engineering, &
Research Center for Energy
Conversion and Storage,
Seoul National University, Seoul, Korea

²Department of Applied Chemistry,
Kumoh National Institute of Technology,
Gumi, Korea

To improve the electrochemical performance of LiCoO₂ above 4.2 V, nanoscale coating of metal oxides (ZrO₂ and Al₂O₃) on LiCoO₂ was reported by Cho *et al.* [1-3]. In this presentation, with nanoscale coating of various metal oxides, the correlation between the electrochemical properties and cobalt dissolution is reported.

As shown in Fig. 1, the amount of cobalt dissolution (measured by ICP-MS) from the LiCoO₂ powder charged up to 4.4 V, after floating for one week at 25°C and 90°C, respectively, correlates well with both the capacity retention and the fracture toughness of the coated metal oxides. The amount of cobalt dissolution from the uncoated LiCoO₂ powders is ~260 ppm at 25°C, while that from the ZrO₂-coated ones is ~30 ppm. A ZrO₂ coating can effectively inhibit cobalt dissolution at 90°C (~200 ppm), which is much smaller than cobalt dissolution from the uncoated powders (~1330 ppm). In addition, cobalt dissolution of ZrO₂-coated LiCoO₂ is not significant even at 4.8 V. The Co-dissolution data will be discussed with the lattice-constant suppression.

References

1. J. Cho, Y. J. Kim, T.-J. Kim, and B. Park, *Angew. Chem. Int. Ed.* **40**, 3367 (2001).
2. J. Cho, Y. J. Kim, and B. Park, *J. Electrochem. Soc.* **148**, A1110 (2001).
3. J. Cho, Y. J. Kim, and B. Park, *Chem. Mater.* **12**, 3788 (2000).

*jpcho@kumoh.ac.kr **byungwoo@snu.ac.kr

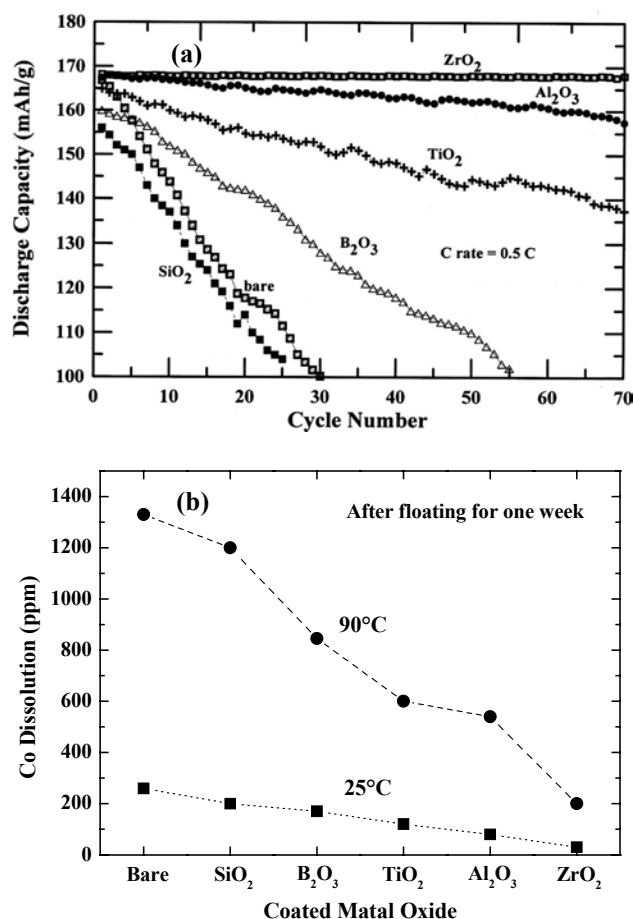


Figure 1. (a) Cycle-life performances for ZrO₂-, Al₂O₃-, TiO₂-, B₂O₃-, SiO₂-coated, and uncoated LiCoO₂. The cells were initially cycled at the rate of 0.1 C, followed by 0.5 C rate between 4.4 and 2.75 V at 25°C. (b) The amount of cobalt dissolution in the electrolyte, from metal-oxide coated and uncoated LiCoO₂ after an initial charge to 4.4 V, and being immersed for one week at 25°C and 90°C.