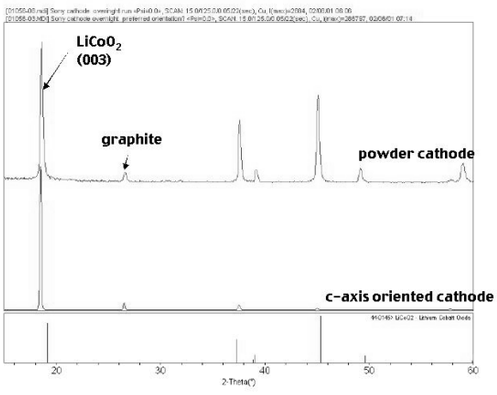
CHARACTERIZATION OF ORIENTED $LiCoO_2$ FROM LITHIUM-ION CELLS

David Ingersoll[1], Weiqing Zhou[2], and Mark A. Rodriguez[1]

[1] Sandia National Laboratories
Albuquerque, NM 87185-1405

[2] Department of Physics, Box 7518, North Carolina State University, Raleigh, NC 27695, USA

Abstract:
Lithium cobalt oxide is a layered material having an anisotropic crystal structure that we have previously found to assume a random orientation in a cast electrode. Recently we have found that in some commercially available cells, the oxide exhibits a preferred orientation. This is seen in Figure 1, which shows the x-ray diffraction pattern obtained from the cathode of a Sony 18650 lithium-ion cell, as well as the powder diffraction pattern of the cathode material that was physically removed from the electrode and that was then ground to obtain a random orientation.



We have also characterized the same electrodes using x-ray absorption spectroscopy (XAS), and we have found that the x-ray absorption near edge structure (XANES) is dependent on the relative orientation of the sample with respect to the x-ray source. In this case the two orientations studied were horizontal (small angle) and vertical (perpendicular) to the incident radiation. The spectra obtained from the horizontal arrangement showed metallic-like spectra, while the vertical arrangement exhibited a spectrum consistent with the cobalt in a higher oxidation state. When the spectra was collected for a powder sample obtained by scraping material from the cathode and then grinding to randomize the sample, only a single spectra was observed regardless of the relative orientation of the sample in the beam. These data suggest an interesting electronic structure of the oxide.

We have obtained data as a function of state of charge of the oxide materials, and these results will be presented and discussed.

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