Innovative Dual-Gradient Cathode Achieves High Voltage and Capacity



Structure ordering/concentration dual-gradient particle with gradient structure from order to disorder towards outer layer and gradient composition from Cobalt-less bulk to Cobalt-enriched surface.

Liu, T., Yu, L., Liu, J., Dai, A., Zhou, T., Wang, J., Huang, W., Li, L., Li, M., Li, T., Huang, X., Xiao, X., Ge, M., Ma, L., Zhuo, Z., Amine, R., Chu, Y. S., Lee, W.-K., Wen, J., & Amine, K. Ultrastable cathodes enabled by compositional and structural dual-gradient design. *Nat Energy* (2024). DOI: 10.1038/s41560-024-01605-8

Work performed in part at NSLS-II

Scientific Achievement



Researchers design an ultrastable layered oxide cathode for Lithium Ion (Li-ion) batteries that can mitigate strain and improve thermal stability under high voltage (≥4.5 V).

Significance and Impact

Current Li-ion cathodes quickly lose capacity under high voltage. This new design could lead to a new generation of Li batteries with both high voltage and high capacity.

Research Details

- The dual-gradient design is characterized by a controlled structure gradient from ordered to disordered when transitioning towards the surface of the cathode material.
- Diffraction and imaging techniques reveal that the disordered surface is electrochemically and structurally indestructible.
- The cathode's design also increases thermal stability and cycling stability.



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