Copper Insertion into Bi-Modified MnO₂ Cathodes Results in a Safe, Energy-Dense, Low-Cost Battery

Scientific Achievement
High resolution elemental tracking reveals the slow incorporation of Cu into a MnO₂ cathode, increasing conductivity and allowing it to achieve high cycle life.

Significance and Impact
Aqueous Zn-MnO₂ could provide a safe alternative to Li-ion batteries if the rechargeability of MnO₂ is improved by a Bi and Cu additive cocktail.

Research Details
– Studies have shown that incorporating Cu in Bi-modified MnO₂ dramatically increases battery cycle life, however the mechanism of this effect is not clear.
– Operando X-ray fluorescence microscopy at NSLS-II Beamline 5-ID (SRX) showed that Cu begins highly coordinated with Bi spatially, and shifts to a correlation with Mn during initial cycling.
– Micro-XANES showed that a zero-valence Cu is produced at the bottom of discharge, inserting into the MnOOH structure and improving conductivity.

Work was performed at Brookhaven National Laboratory and the City College of New York

G. Yadav, J. Gallaway, D. Turney, M. Nyce, J. Huang, X. Wei, S. Banerjee, “Regenerable Cu-intercalated MnO₂ layered cathode for highly cyclable energy dense batteries” Nature Communications 8:14424, 2017