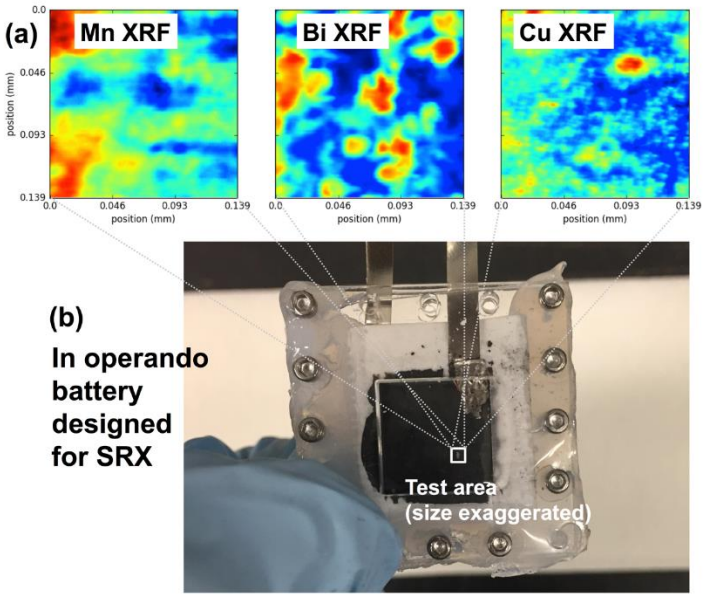
Copper Insertion into Bi-Modified MnO_2 Cathodes Results in a Safe, Energy-Dense, Low-Cost Battery



(a) X-ray fluorescence microprobe imaging of Mn, Bi, and Cu in the battery cathode. (b) Photography of the test battery designed for the SRX beamline at NSLS-II.

G. Yadav, J. Gallaway, D. Turney, M. Nyce, J. Huang, X. Wei, S. Banerjee, "Regenerable Cu-intercalated MnO_2 layered cathode for highly cyclable energy dense batteries" **Nature Communications** 8:14424, 2017

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

Scientific Achievement

High resolution elemental tracking reveals the slow incorporation of Cu into a MnO_2 cathode, increasing conductivity and allowing it to achieve high cycle life.

Significance and Impact

Aqueous Zn-MnO_2 could provide a safe alternative to Li-ion batteries if the rechargeability of MnO_2 is improved by a Bi and Cu additive cocktail.

Research Details

- Studies have shown that incorporating Cu in Bi-modified MnO_2 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.

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