

Supporting Information

Understanding Oxygen Activation on Metal- and Nitrogen-Codoped Carbon Catalysts

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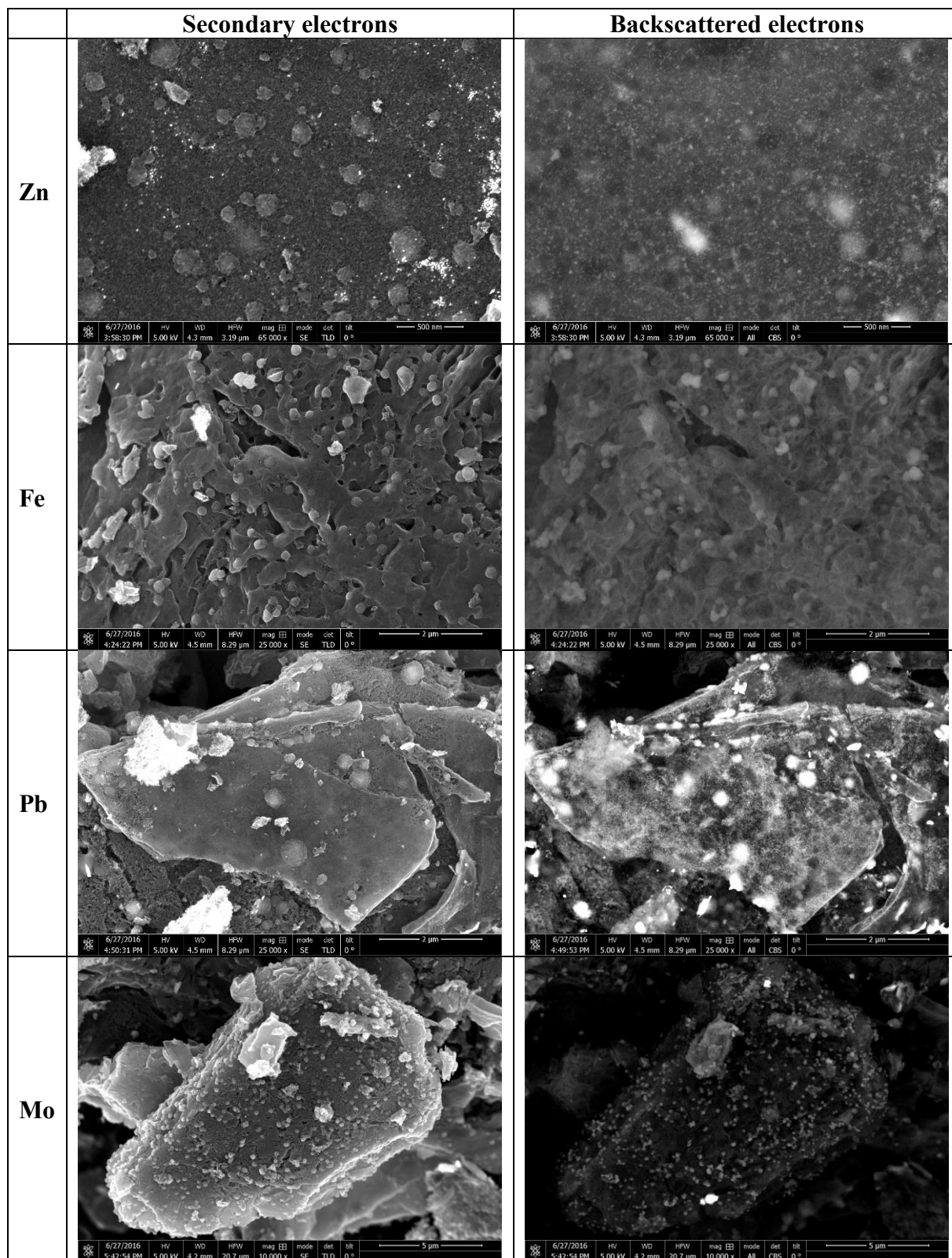


Figure S1. Scanning electron micrographs of several of the M–N–C composites, imaging the same region by secondary electrons (left column) and back-scattered electrons (right column).

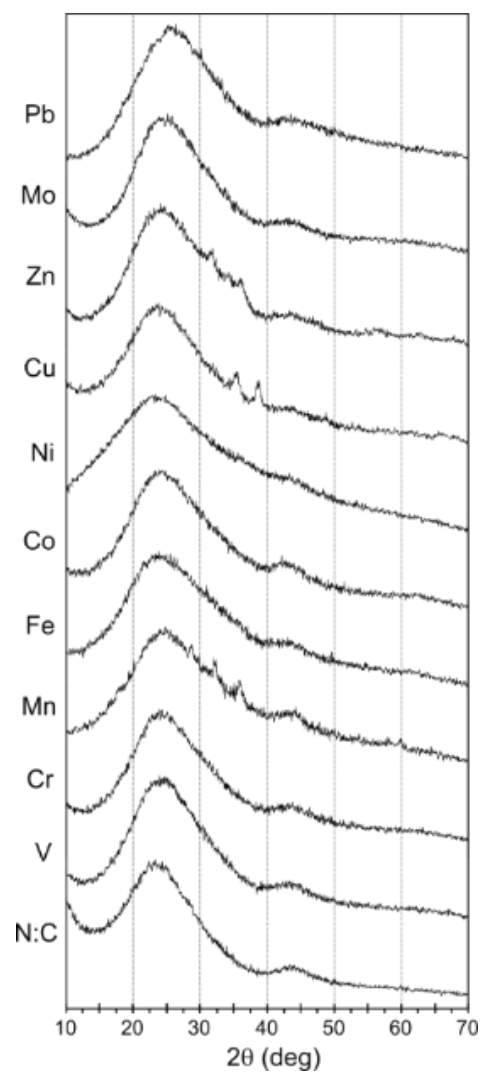


Figure S2. X-ray diffractograms of all M-N-C composites.

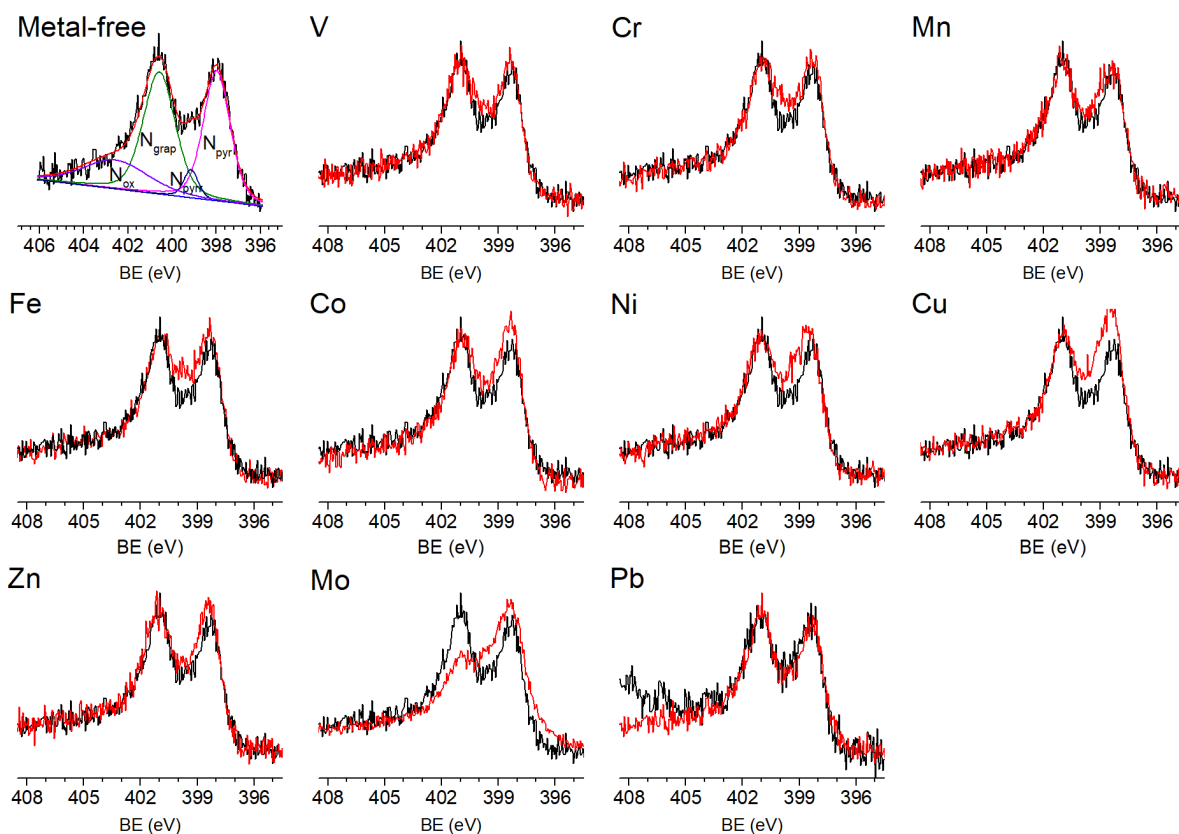


Figure S3. N 1s XPS of the metal-free N-doped carbon (black trace) and the M–N–C composites (red traces). Binding energies are calibrated vs. the C 1s peak at 284.8 eV for all spectra, since they all share the same carbon support. Intensities are normalized relative to the peak at 400.9 eV, except for Mo, where the M–N–C was further divided by 2.4 to present the two traces on the same scale. The metal-free carbon spectrum is deconvoluted, using linear background, a 30:70 mix of Gaussian and Lorentzian peak shapes, and literature recommendations for the assignment.^[1–11] Four nitrogen types were used: pyridinic (N_{pyr} , 398.3 eV), pyrrolic (N_{pyrro} , 399.5 eV), graphitic (N_{grap} , 400.9 eV), and oxidized (N_{ox} , 402.9 eV).

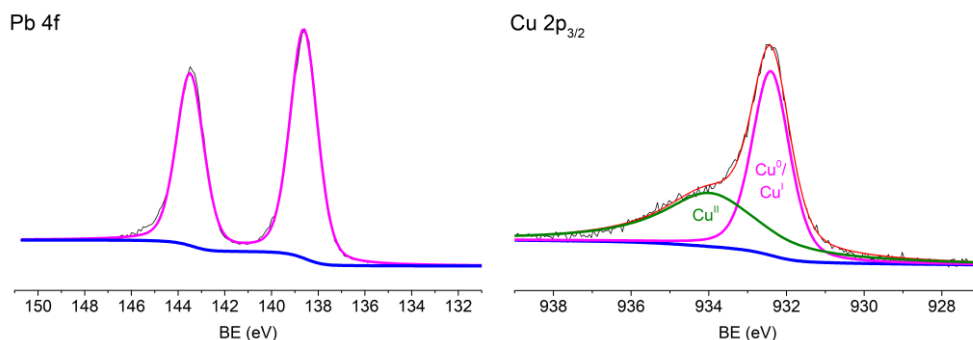


Figure S4. Mathematically-deconvoluted X-ray photoelectron spectra of Cu 2p (in the $2p_{3/2}$ region, left) and of Pb 4f (right).

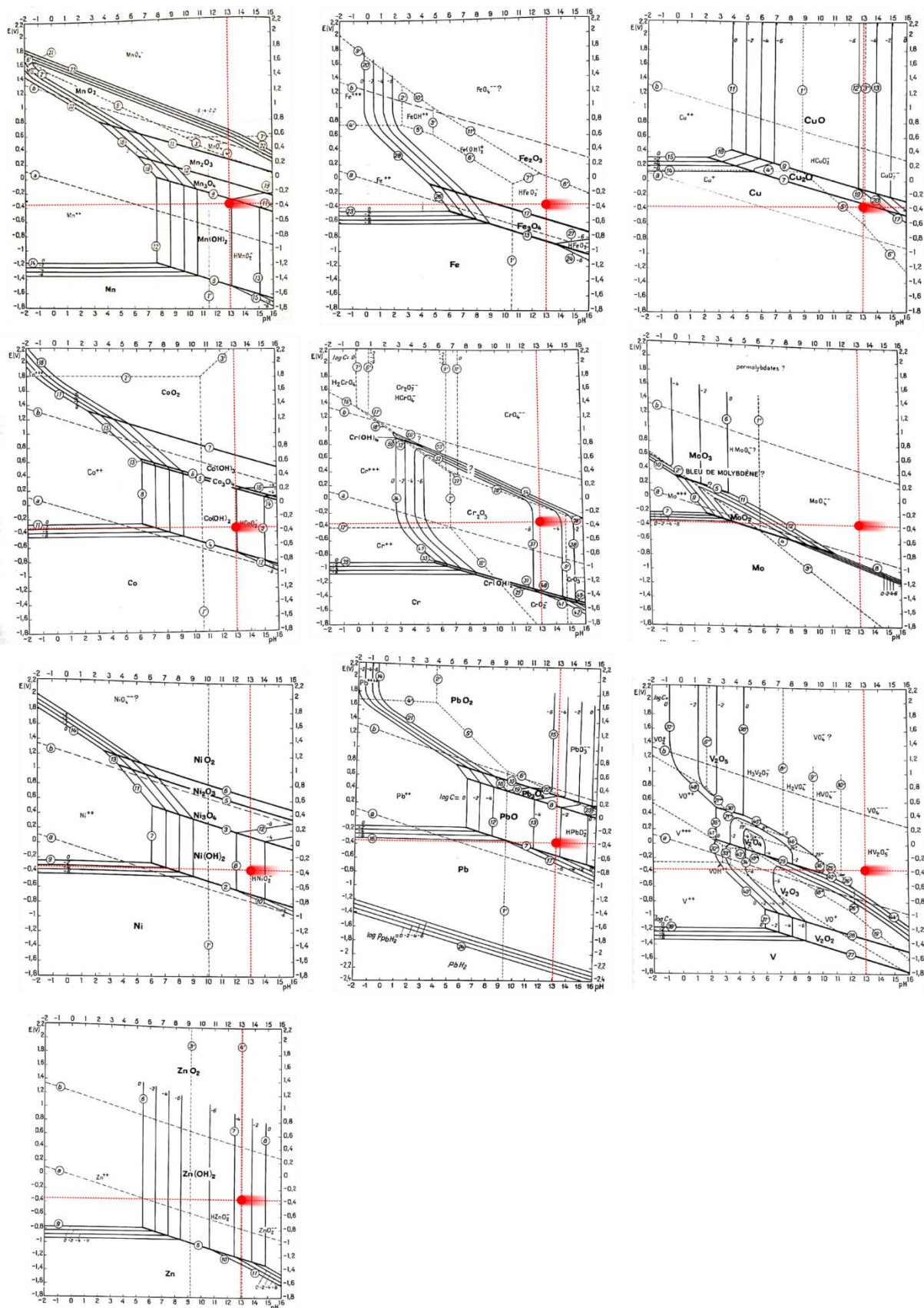


Figure S5. Pourbaix diagrams of the metals studied in this work. The red dot marks the near-surface conditions during alkaline ORR electrocatalysis: $E = -0.35$ V vs. RHE, and pH starting from pH 13 and rising to $\sim 14-15$ due to local OH^- production during ORR.