Design of Pt-Free Complex Metal Oxide Electrocatalysts for Oxygen Reduction Reactions in Fuel Cells Peter Khalifah, Department of Chemistry, Stony Brook University

While fuel cells provide a much more efficient way of utilizing the energy stored in chemical fuel than traditional combustion routes, their viability is limited by the high costs and limited availability of the noble metal catalysts like platinum that are routinely used at their electrodes. New classes of complex oxides, oxynitrides, and nitrides are being investigated for their utility as fuel cell oxygen reduction reaction (ORR) catalysts, with the goal of developing more active, less expensive, and acid-stable alternatives to current noble metal systems.



In addition to finding a number of new materials with ORR activity in acidic solutions, we have demonstrated that Co-Mo-O-N rock salt compounds can have an activity in basic media that is only slightly than that of platinum. The catalysis is found to occur through primarily a 4-electron mechanism. The complex structure and morphology of these semiconductors has been elucidated through SEM/EDX, TEM/EELS, XANES, EXAFS, XPS, and XRD experiments.