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Composition-structure-activity relationship for fuel cell catalysts by in operando XRD

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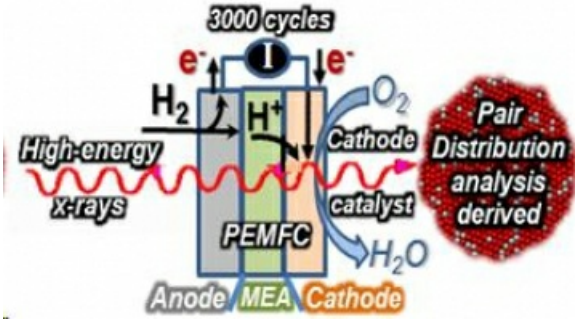
The activity and stability of nanoalloy catalysts for chemical reactions driving devices for clean energy conversion, such as the oxygen reduction reaction (ORR), depend critically on optimizing major structural and morphological characteristics of the nanoalloy particles such as chemical composition, phase type, 3D atomic ordering, surface area and dispersion for the harsh operating conditions inside the devices. The effort requires good knowledge of how changes in each of these characteristics would affect the catalytic functionality of the nanoalloys and, hence, the device performance. We will present results from in operando energy dispersive x-ray spectroscopy and high-energy x-ray diffraction studies, including atomic pair distribution analysis, on the continuous repositioning, atomic-level reconstruction and changes in ORR activity experienced by binary and ternary nanoalloy catalysts of the (Pt, Pd) –(Ni, Co, Cu and Sn) family as they function at the cathode of a proton exchange membrane fuel cell. Also, we will discuss how the knowledge obtained can help produce more efficient and affordable nanocatalysts for energy related applications and so help reduce mankind's dependence on fossil fuels.



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