

Role of Transition Metal in Non-Noble  
Metal Cathode Catalysts (NNMCs) for  
Proton Exchange Membrane (PEM) Fuel  
Cells

*Deepika Singh, Juan Tian, Kuldeep  
Mamtani, Umit S. Ozkan*

*Department of Chemical and Biomolecular  
Engineering,*

*The Ohio State University, Columbus OH*

The nature and role of the transition metal in NNMCs for the oxygen reduction reaction (ORR) has been widely debated in literature in recent years. At OSU, we have prepared nitrogen-containing carbon nanostructure (CN<sub>x</sub>) catalysts on an oxide support by acetonitrile decomposition at high temperatures, followed by an acid wash to leach out the inactive oxide and surface metal<sup>[1, 2]</sup>. These CN<sub>x</sub> catalysts show significant activity for ORR. CN<sub>x</sub> contains the transition metal (Fe or Co) encased within carbon, which is inaccessible to oxygen to catalyze the ORR. Poisoning studies on CN<sub>x</sub> with the help of known industrial poisons for transition metals such as H<sub>2</sub>S or CO, revealed that they were not susceptible to deactivation upon exposure to these poisons<sup>[3, 4]</sup>.

More recently we have conducted in situ X-ray absorption spectroscopy studies to observe changes in the metallic phase of CN<sub>x</sub> catalysts during their growth at a high temperature, with acetonitrile decomposition. These experiments were conducted to compare two supports: MgO and Vulcan carbon, impregnated with Co. Further spectroscopic characterization such as X-ray photon spectroscopy, X-ray

diffraction and transmission electron microscopy (TEM), revealed differences in the structure and composition of the catalysts obtained on the two supports, which will be discussed.

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#### References

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