179d Non Precious Metal Catalysts for Pemfc Applications

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Recent advances have made Proton Exchange Membrane Fuel Cells (PEMFC) a leading alternative to internal combustion and diesel engine transportation. A major impediment in the commercialization of the fuel cell technology is the high content of supported platinum electrocatalysts used for oxygen reduction and the cost involved. Presently Pt and Pt alloys are widely used as anode and cathode materials. Despite a cathodic overpotential loss of 20%, Pt and its alloys are still preferred for their resistance towards corrosion in acidic media. Pt however, being an expensive metal of low abundance, it is of interest for researchers to develop a corrosion resistant non noble metal substitutes. Development of selective oxygen reduction non noble catalyst is also of interest for Direct Methanol Fuel Cells (DMFC), where methanol cross over and oxidation of methanol at the cathode remains an impeding factor for its commercialization. In the last few years, several transition metal compounds have been proposed as oxygen reduction reaction (ORR) selective catalyst. Co based macrocyclic compounds have shown improved activity towards oxygen reduction. However, in addition to their expensive nature, such macrocyclic compounds are highly instable in acidic media. The objective of the present study is to generate MN4 structures from low cost organic precursors with improved activity and stability. Co based metal catalysts from nitrogen donating organic compounds were synthesized and characterized. The catalysts synthesized exhibit, four electron reduction of molecular oxygen and improved activity in comparison with other state of art non precious metal catalysts. The effect of Co wt%, Co: nitrogen ratio, heat treatment temperature and nature carbon substrate on the activity were studied and optimized. Influence of different surface groups on carbon such as N,O and S were studied with the objective of improving the activity and stability of the non noble metal catalysts. The obtained catalysts show comparable performance with ETEK 20% Pt/C catalysts under RRDE test conditions.