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Maximization of quadruple phase boundary for alkaline membrane fuel cell using nonstoichiometric a-MnO2 as cathode catalyst

X.Shi[ad], S.Ahmad[b], K.Pérez-Salcedo[c], B.Escobar[c], H.Zheng[d], A.M.Kannan[a]

[a] Fuel Cell Laboratory, The Polytechnic School, Ira A. Fulton Schools of Engineering, Arizona State University, Mesa, AZ 85212, USA
[b] University of Engineering & Technology Peshawar, Peshawar, Khyber Pakhtunkhwa, 25120, Pakistan
[c] Centro de Investigación Científica de Yucatán, Carretera Sierra Papacal – Chuburná Puerto, Km 5, Sierra Papacal, Mérida, C.P. 97302, Yucatán, Mexico
[d] Energy Centre, Council for Scientific and Industrial Research (CSIR), Pretoria, Gauteng 0184, South Africa

Abstract

Oxygen can only be reduced at the quadruple phase boundary (catalyst, carbon support, ionomer and oxygen) of the cathode catalyst layer with non-conducting electrocatalyst. To maximize the quadruple phase boundary sites is crucial to increase the peak power density of each membrane electrode assembly. The quadruple phase boundary is depending on the ratio of catalyst, carbon support and ionomer. The loading of catalyst layer is also crucial to the fuel cell performance. In this study, non-stoichiometric a-MnO2 manganese dioxide nanorod material has been synthesized and the ratios of carbon, ionomer and catalyst loadings were optimized in alkaline membrane fuel cell. In total, ten membrane electrode assemblies have been manufactured and tested. Taguchi design method has been applied in order to understand the effect of each parameter. The conclusion finds out the ionomer has more influence on the alkaline membrane fuel cell peak power performance than carbon and loading.