Porous cathode based on graphene-carbon nanotube hybrid for proton exchange membrane fuel cell

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Graphene, which is a one-atom-thick two-dimensional layer of sp2-bonded carbon, has attracted considerable attention owing to its unique physical, chemical and electrical properties. Graphene sheets used for electro-catalytic oxygen reduction reaction showed higher performance and electro-chemical surface areas than the commercial catalyst. However, electrodes prepared by graphene have an obstacle in mass transfer of the chemical reactants and products to and from the active sites due to graphene's morphological characteristics. Carbon nanotubes are some of the most promising materials for the design of functional thin films, including those for catalytic membranes and for a range of electro-chemical energy conversion and storage devices owing to their unique morphological characteristics and physical properties, including one-dimensional high aspect ratio, large surface area, high electrical conductivity and superior chemical and mechanical stabilities. In this study, Porous Pt-graphene/multiwalled carbon nanotube hybrid cathodes were fabricated for proton exchange membrane fuel cells and their electro-chemical performances were examined.