# Influence of Metal Nanoparticles in Proton Conductivity and Water Absorption of Polymeric Membranes for Fuel Cells

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**ABSTRACT**

Polymeric membrane fuel cells (PEMFC) are a reality nowadays in several popular applications, although, their massive use is still not achieved due to the high cost of some components. One of the most expensive components is the proton exchange membrane, where NAFION® has proved to have high performance. Such performance has been associated, apart of the membrane chemical nature, to its capacity to absorb water and hence influence its proton conductivity. Alternative membranes of sulfonated poly(styrene-co-acrylic acid) copolymers were prepared, as well as gold and silver nanoparticles through their salts reduction. The water absorption and proton conductivity of the membrane were evaluated after addition of such metal nanoparticles into the copolymer at 3 different concentrations. Water absorption increased independently of quantity or nature of the nanometal, comparing with a non-doped membrane. Such result can be associated to a deformation of the ionic clusters in charge of the proton conductivity. However, proton conductivity measured through electrochemical impedance spectroscopy (EIS) show a reduction of their values after addition of nanparticles; independently of nature and concentration in the copolymer. On the other hand, a charge transfer resistance, related to the resistance to transfer electrons at the membrane/electrode interface, was enhanced for the nanoparticle doped membranes. Considering that nanoparticles can migrate to the membrane surface during preparation, the reduction in proton conductivity values could be associated to the specific electron clouds for the evaluated metals, which in turn improve conduction of the electrons involved during the process.

*Keywords:* Fuel Cells, nanoparticles, protonic conductivity.