PRIN 2010-2011 "NAMED-PEM"

MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITA' E DELLA RICERCA

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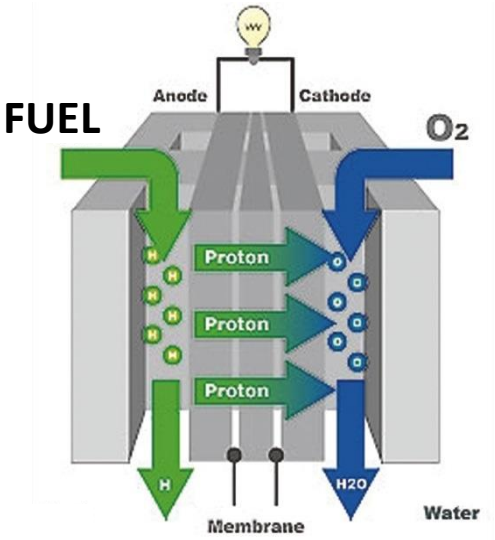
Advanced nanocomposite membranes and innovative electrocatalysts for durable polymer electrolyte membrane fuel cells, NAMED-PEM



Aim of this project is to identify materials for application in diverse energy producing systems (polymer electrolyte fuel cells (PEMFCs) for stationary, automotive and portable applications), hence operating in a wide range of operating conditions in terms temperature, relative humidity and fuel. The goal of the Research Unit of The University of Rome Tor Vergata is to develop innovative composite electrolytes for PEMFCs to improve the performance and reduce the costs of the present state-of the-art materials.

The versatile properties of organic/inorganic hybrid materials was exploited to prepare acidic hybrid fillers which structure and morphology was be modulated to enhance interface interactions in polyaromatic polymers (PAS)-based nanocomposite membranes, thus producing innovative electrolytes with enhanced conduction and structural stabilization.

Ionomers directly sulfonated on the main chain and side-chain substituted polymers were investigated. The nature and the amount of side-chain substituents was tuned to control the ionomer morphology.

Different types of fillers was prepared: nanostructured ceramic oxides (TiO2, ZrO2, SnO2) covalently functionalized with alkyl and perfluorinated chains terminating with sulfonic acid groups (-SO3H). Functionalization strategies are aimed to obtained materials fillers highly stable in FC operating conditions and characterized by high surface acidity, proton conductivity and compatibility with the host polymer.

Composite membranes were prepared by dispersion in PAS matrices of several fillers. Characterization procedures was be carried out in collaboration with the other Research Units. The combined analysis of DSC, NMR-derived water diffusivity, and EIS-derived proton conductivity was allow to identify most promising composite membrane to prepare MEAs (membrane electrode assemblies) with commercial electrodes to be tested in direct methanol fuel cell (DMFC).