PEFC anodes based on different carbon materials supporting electro-crystallized nanostructured Pt particles

Paoletti C.[1], Cemmi A.[1], Serra E.[2] and Pozio A.[1]*

[1]TER, [2]FIM MAT-TEC ENEA R.C Casaccia, Via Anguillarese 301, Rome, IT-00123

Abstract

This work is focused on the study of electro-crystallization of Pt nanostructured particles to be used as a catalyst on various carbon supports, included nanotubes (CNTs), for polymer electrolyte fuel cells electrodes (PEFCs).
Electrochemical single- and multi-pulsed galvanostatic deposition has been applied defining the best operational parameters leading to a highly nanostructured electrode morphology. Electrochemical measurements such as impedance spectroscopy and polarization curves have been carried out together with a morphological analysis by means of scanning electron microscopy.
The influence of electro-deposition parameters on the Pt loading and the Pt:Nafion optimal ratio were investigated and optimized.
The investigated materials have been then applied as gas diffusion electrodes in a lab-test PEFC system based on a single-cell with a 5 cm^2 area.
The most promising anode has been obtained from deposition of Pt particles on CNTs substrate electrode. Despite the extremely low amount of electrodeposited catalyst (67,8 $\mu g cm^{-2}$), CNTs electroactive properties and their high electron transfer kinetics allowed to achieve high current density values. This result is noteworthy if compared to the commercial PEFCs working with 10 times higher Pt loads and strongly encourages its implementation in a real device.

*Corresponding Author: Claudia Paoletti, Tel.:+39630483169, claudia.paoletti@csaccia.enea.it