Enhanced mass transport of polymer electrolyte membrane fuel cell with nano-scale ionomer distribution control in catalyst layer

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A common structure of a catalyst layer for a polymer electrolyte membrane fuel cell is a mixture of the ionomer and the carbon supported Pt catalyst. However, because of the high polar-polar attraction, the ionomer generally tends to distribute on Pt surface forming few nanometer thick film. The ionomer films on Pt surface retard the oxygen transfer and adversely affect the performance especially at a low Pt content. In this sense, nano-scale ionomer distribution modification toward the ionomer film reduction is needed for the performance enhnacemnet. Herein, it is realized by selective masking of Pt surface with a typical hydrophobic adsorbate for Pt. The molecular dynamic simulations demonstrate that the hydrophobic masking induces a lowered interaction between the Pt and ionomer. The lessened ionomer film is observed and the recovery of the Pt activity is carried out by electrochemical desorption of the mask during the break-in step. The lessened ionomer film results in an enhanced power performance as a consequence of the enhanced oxygen transport in catalyst layer.