119g Catalyst Layer Network Formation in Polymer Electrolyte Membrane Fuel Cells

Christine Hronec and Yossef A. Elabd

Current research is focused on optimizing fuel cell efficiency, where one focus area is the reactant gas/Pt/Nafion® triple phase boundary in the catalyst layer (CL). This research explores various CL deposition techniques and membrane electrode assembly fabrication techniques. Several studies prove that fuel cell preparation methods directly affect performance. In order to maximize performance, a new CL deposition technique was investigated: in situ sonication, where the morphology and fuel cell performance was compared to the standard hand painting technique. SEM images reveal that the in situ sonication method produced a more uniform, well dispersed, and less porous CL compared to the standard method. The fuel cell performance of this new technique was considerably lower than the standard CL fabrication technique. However, SEM images of the hand painted CL after fuel cell testing displayed different CL structures, a network of Nafion® nanofibers connecting the catalyst particles. This newly discovered network microstructure and not the CL microstructure prior to fuel cell testing may be a primary cause for differences in fuel cell performance. This work thoroughly investigates the formation of Nafion® nanofibers and presents a new approach to fuel cell electrode optimization through a three-dimensional networked microstructure.