The thermal decomposition of a linear perfluoropolyether peroxide produces perfluoropolyether radicals that link to the unsaturated moieties of carbonaceous materials. The decomposition occurs between 110-200 °C and generates radical species with half-life time of 30 mins.

A ink for microporous layer (MPL) was prepared by dispersing carbon black and perfluoropolyether peroxide (1:1 ratio) in a perfluorinated solvent. The ink was deposited on carbon cloth by spray deposition method. The peroxide was decomposed between 110-200 °C under nitrogen. The fraction of PFPE that did not link the carbonaceous matrix was removed by washings with perfluorinated solvent. Thereafter, the sample was dipped in a 2% solution of PFPE peroxide and, then, treated between 110-200 °C under nitrogen in order to obtain a uniform hydrophobization of the carbon cloth. 10%\textsubscript{PFPE} PFPE was linked to the carbon black for MPL and 1%\textsubscript{PFPE} PFPE was linked to the carbon cloth backing layer.

The PFPE GDL was tested in a Polymeric Electrolyte Membrane Fuel Cell (PEMFC) and the results were compared to a standard PTFE-hydrophobized GDL (10%\textsubscript{PFPE} PTFE).

Conclusions

PFPE chains were covalently linked to carbon black and carbon cloth in order to obtain superhydrophobic carbonaceous functional materials. The PFPE-modified carbon-based materials were tested as a Gas Diffusion Layers (GDL) in a PEMFC. Polarization curves showed that PFPE-functionalized materials provided better performances than standard PTFE-hydrophobized ones, especially at high current densities.