IONIC LIQUID BASED MEMBRANES WITH ENHANCED PROTON CONDUCTIVITY FOR MEDIUM TEMPERATURE FUEL CELLS.

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Introduction

Proton conductive membranes have had increasing interest for researchers, due to its important applications in proton exchange membranes fuel cells (PEMFC). Inside a PEMFC there must be an ionic transport agent, who is in charge of carrying the protons generated in one side of the fuel cell (anode) to the other (cathode). Usually, water does this task, having temperature as a limitation factor; above 80 ºC water runs out of the membrane making it useless. Besides that, it had been established that high temperature decreases catalytic poisoning, improving the efficiency of the entire process[1].
Therefore, the incorporation of an ionic transport agent inside the membrane, who is capable of maintain its properties along the increase of temperature, has the highest importance to improve the performance of a fuel cell.
Ionic liquids are the chosen substance to do this job, because of its good thermal properties, ionic conductivity and low vapor pressure that allows high operation temperature. The major challenge is to keep the ionic liquid in the structure of the membrane and for accomplish this target; organically modified montmorillonite was used in this work, in order to maintain the ionic liquid embedded in the membrane, keeping a high conductivity[2].

Results and discussion

Organic modification of motmorillonite has shown to be well succeeded based on the results of FTIR and XRD.

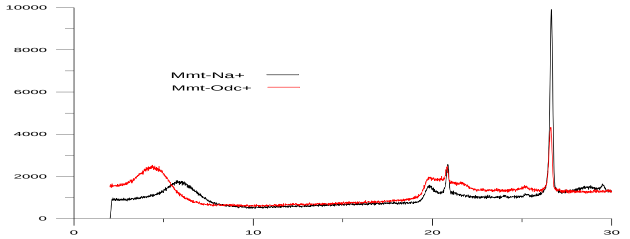

Figure 1. XRD pattern of organically modified montmorillonite (red). Comparison with sodic montmorillonite (black)

Montmorillonite incorporation on hybrid (sPEEK + demaTfO ionic liquid) membranes helped to improve the retention of the ionic liquid in the membrane, maintaining a good conductivity.
It was observed an increasing on conductivity with increasing of montmorillonite content, suggesting the existence of a critic montmorillonite concentration where the conductivity performance is the highest.

% montmorillonite	0	0,5	1	3
σ (ms/cm)	--**	0,75	3,20	7,92

Table 1. Conductivity of hybrid membranes at 50ºC as a function of Montmorillonite content, refered to 1 g of polymer and 0,3 g of demaTfO ionic liquid. **Steady state not attained

It has been observed an increasing in conductivity by increasing operation temperature, attaining 44 mS/cm at 70ºC for the membrane with 1% weight percent. This value represents a high conductivity for this kind of membranes, comparable to the nafion® conductivity, which is the reference value due to the fact of nafion® be the most used material for fuel cell purposes[3]. Currently, the temperature dependence analyses of membranes conductivities are in course.

Conclusions

The searching for the critic montmorillonite concentration is crucial for the purpose of improving the ionic conductivity of the system. Relation between montmorillonite content and thermal-mechanical properties must be done in order to find a proper concentration of montmorillonite that allows a better understanding of the influence that this material has in the performance of the membranes.

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