Ionic liquids in the control of the poly(vinylidene fluoride-co-hexafluoropropylene) membranes morphology

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INTRODUCTION

The development of polymer membranes with tailored micro-morphology and wettability is a demand in the areas of filtration, sensors or tissue engineering, among others. Poly(vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP) is a thermoplastic copolymer and one of the most interesting polymers to be used in these areas due to its good properties. However, the control of the morphology is a complicated task and is mostly restricted to the use of solvent evaporation (SE) techniques [1]. In this way, ionic liquids (ILs), molten salts with melting points lower than 100 °C, which stand out for their good properties, such as high thermal stability or nonflammability, are a promising alternative for the control of morphology in certain materials since the large number of ionic liquids that exist allows to tailor the most suitable combination in order to meet the desired properties [2-3]. In this work, the production and the characterization of PVDF-HFP@ionic liquid composite membranes using different ionic liquids and methodologies are described in detail (figs. 1-6).

Figure 1: SEM (cross-section) and contact angle images for the different samples.

Different morphologies and properties in function of the ionic liquid present in the membrane.

RESULTS

After immerse the membranes in water we can appreciate a higher hydrophobicity on the membranes, nonetheless, the membranes morphology is not affected. The percentage of polymeric piezoelectric β-phase is maintained or even increased.

Figure 2: Contact angle estimated for the samples.

Figure 3: Images of the Contact Angle Measurements as a function of time of the different samples dried at 80 °C, before and after immersion in ILs.[6]

Figure 4: Elastic moduli estimated for the samples.

Figure 6: FTIR-ATR spectra of the different membranes dried at 80 °C, (a) before immersion in water (b) after immersion in water.

DISCUSSION & CONCLUSIONS

• The polymer membrane properties can be tuned using ILs.
• Morphology, wettability or mechanical properties change depend on the production methodology employed as well as on the type of ionic liquid used.
• After the immersion of membranes in water, the morphology is maintained, but it recovers its hydrophobic properties as well as its thermal stability until temperatures higher than 400 °C. The percentage of piezoelectric β-phase is maintained or even increased.
• The possibility to tailor the membranes morphology by the variation of the IL type opens new possibilities in the area of membranes production, since the wide range of different IL structures predicts a huge variety of different membrane structures.

REFERENCES


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