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

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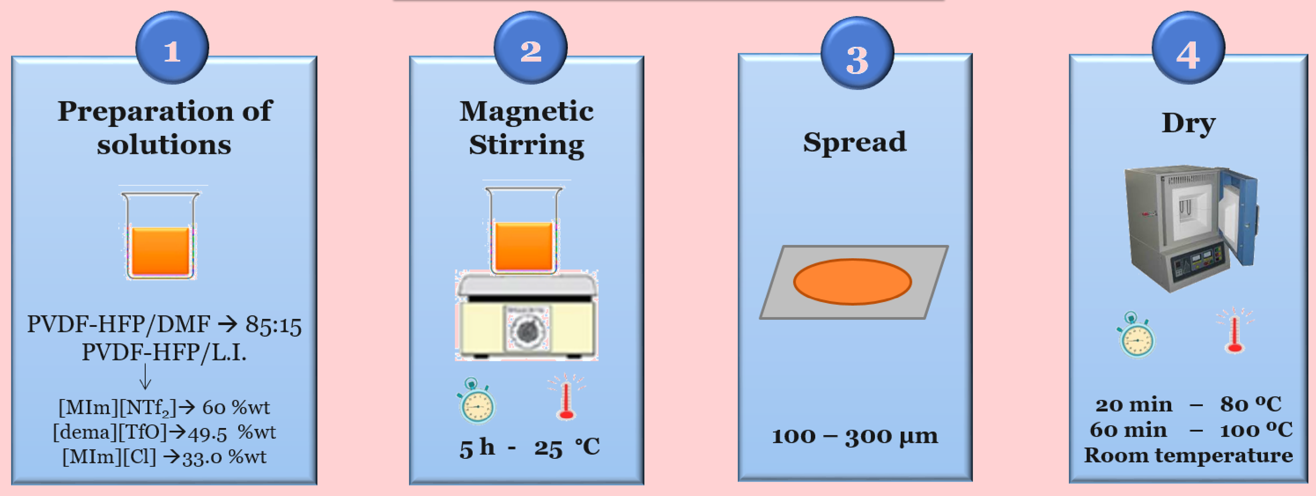
INTRODUCTION

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).

EXPERIMENTAL



The composite properties were analyzed by **Scanning Electron Microscopy - SEM** (JEOL JSM-7000F), **Contact Angle** (NEURTEK OCA 15EC DATAPHYSICS), **Mechanical Test** (Shimadzu AGS-500NJ), **Thermogravimetric Analysis - TGA** (NETZSCH STA 449F3) and **Infrared Spectroscopy – FTIR** (Jasco FT/IR-6100 spectrometer).

RESULTS

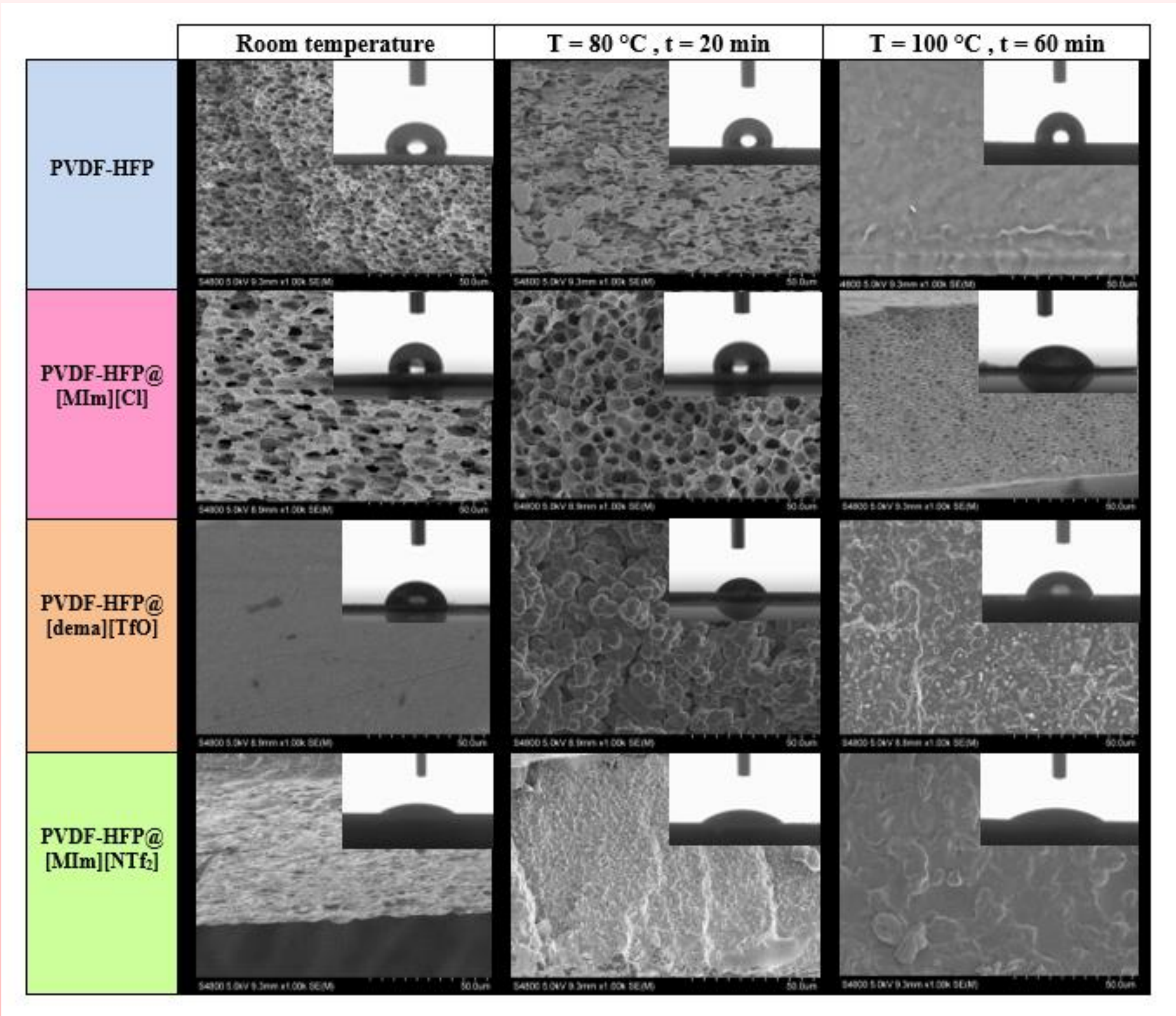


Figure 1 : SEM (cross–section) and contact angle images for the different samples.

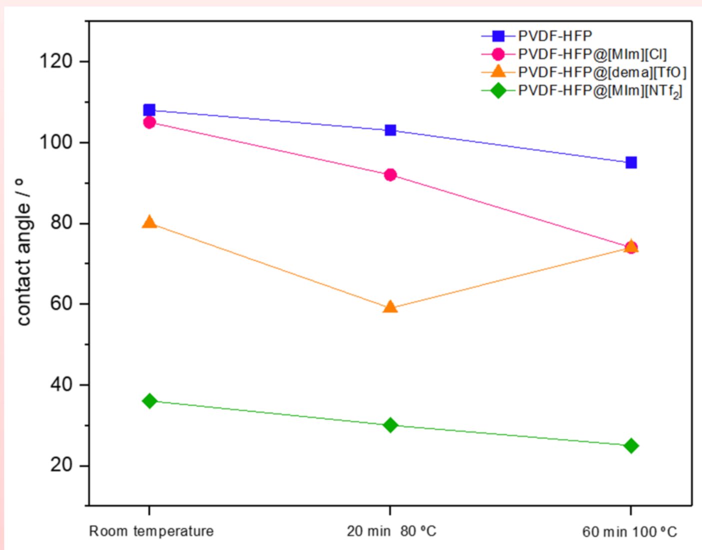


Figure 2 : Contact angle estimated for the samples.

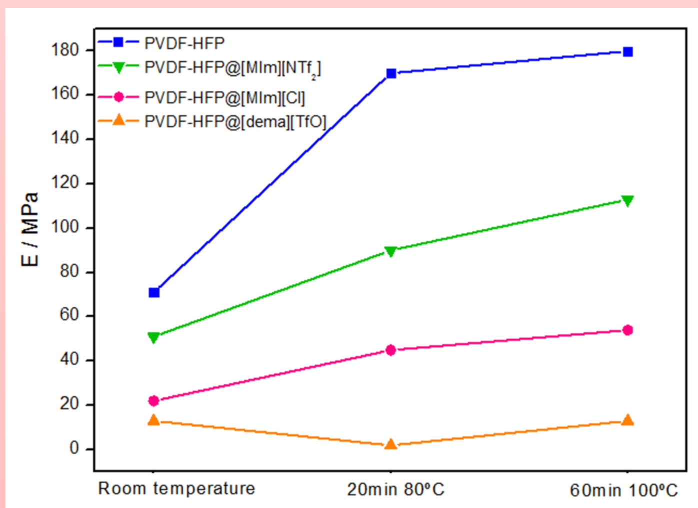
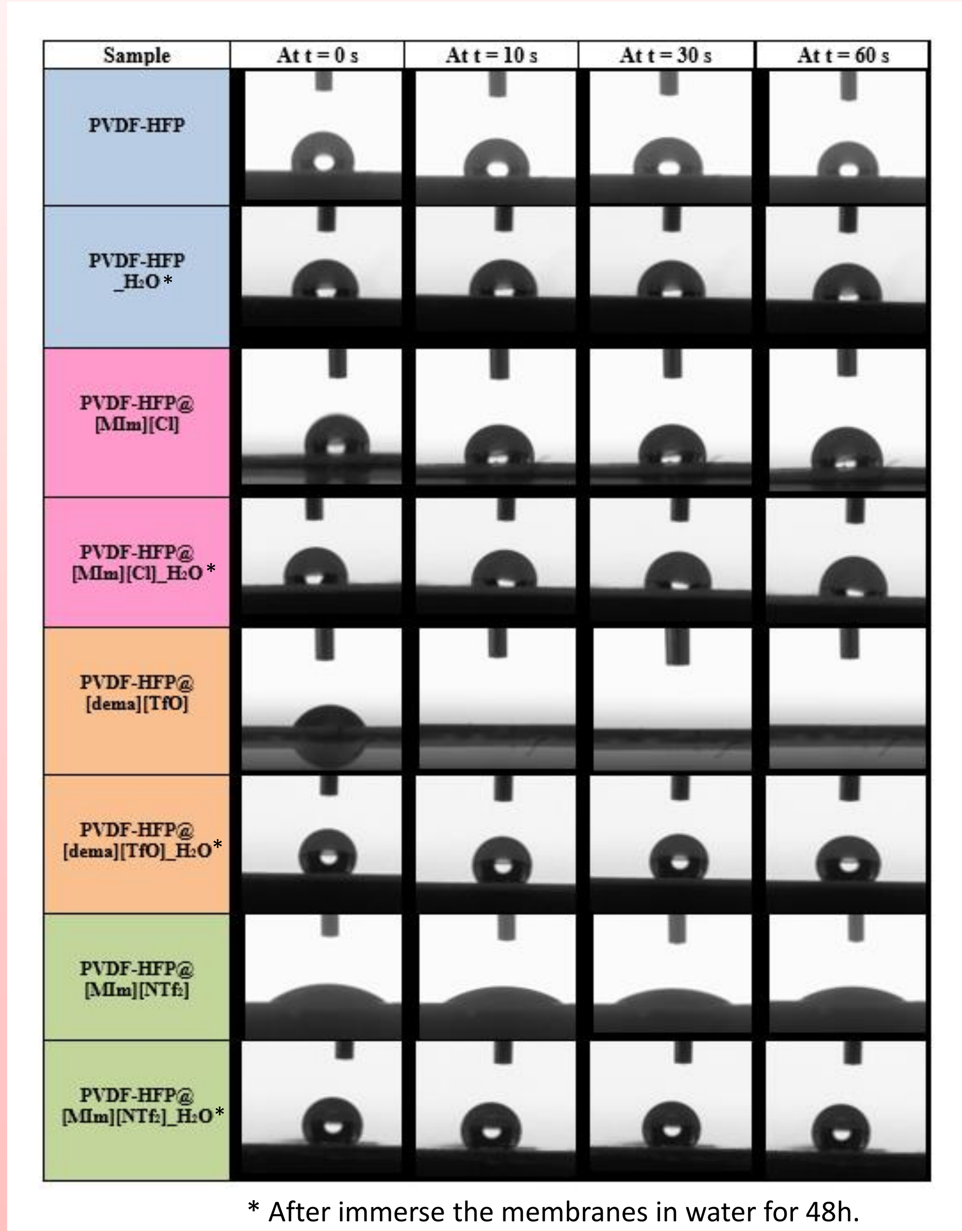


Figure 4: Elastic module estimated for the samples.



* After immerse the membranes in water for 48h.

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 H_2O).

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

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 polymer piezoelectric β-phase is mantained or even increased.

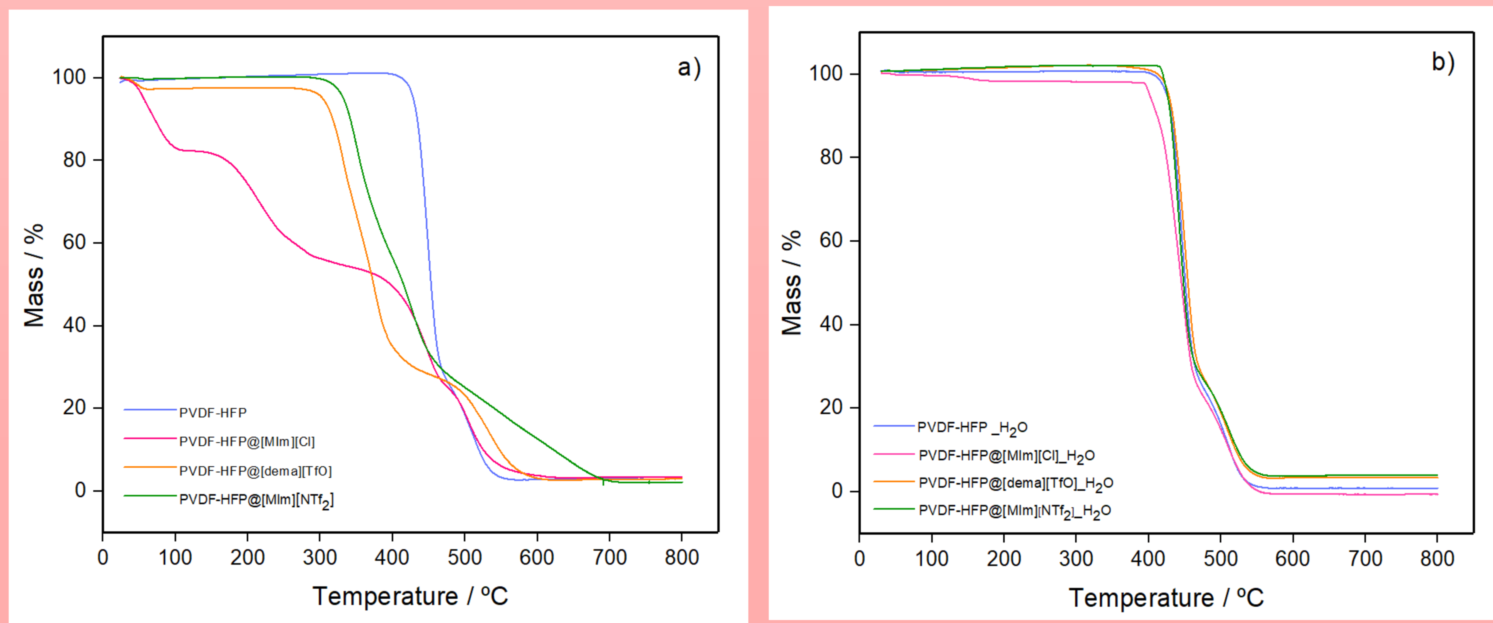


Figure 5 : Thermogravimetric curves for the membranes dried at 80 °C, (a) before immersion in water (b) after immersion in water.

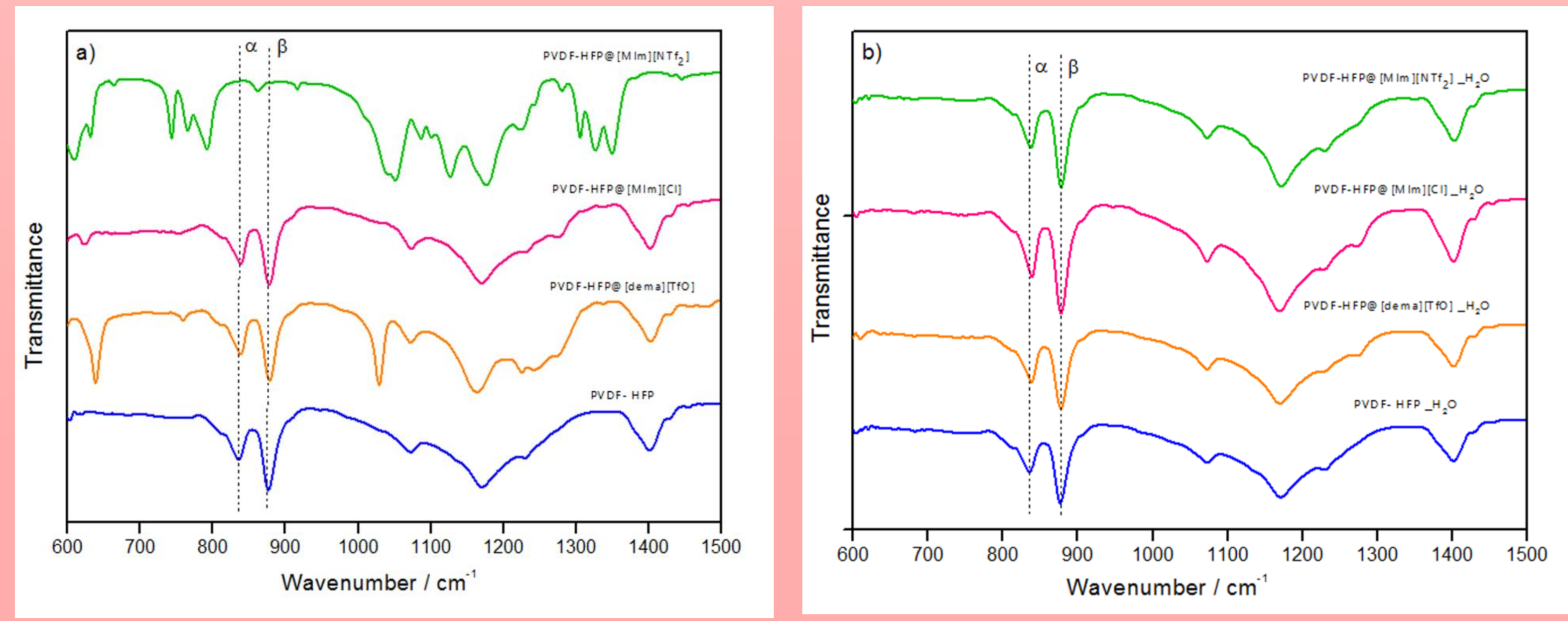


Figure 6 : FTIR-ATR spectra of the different membranes dried at 80 °C, (a) before immersion in water (b) after immersion in water.

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 ºC. The percentage of piezoelectric β-phase is mantained 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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ACKNOWLEDGEMENTS

This work was financially supported by the "Ministerio de Economía, Industria y Competitividad" (MAT2016-76739-R(AEI/FEDER, UE)) and by the "Gobierno Vasco" (KK-2016/00095-LISOL, program Elkartek). The technical and human support provided by SGiker (UPV/EHU) is gratefully acknowledged. P. GSaiz thanks the BCMaterials center for the formation scholarship and to the Dr. J.L. Vilas for providing the equipment for contact angle measurements. A.C. Lopes thanks to MSCA-IF-2015 (Marie Skłodowska Curie Actions) of the European Union's Horizon 2020 Programme for the received funds under grant agreement n° [701852].