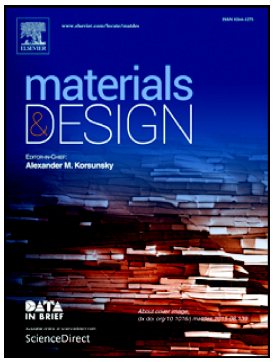
Accepted Manuscript



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

Paula GSaiz, Ana Catarina Lopes, Simone Eizagirre, Roberto Fernández de Luis, María Isabel Arriortua

PII: S0264-1275(18)30480-5
DOI: doi:10.1016/j.matdes.2018.06.013
Reference: JMADE 3983

To appear in: *Materials & Design*

Received date: 9 May 2018
Revised date: 5 June 2018
Accepted date: 6 June 2018

Please cite this article as: Paula GSaiz, Ana Catarina Lopes, Simone Eizagirre, Roberto Fernández de Luis, María Isabel Arriortua , Ionic liquids for the control of the morphology in poly(vinylidene fluoride-co-hexafluoropropylene) membranes. Jmade (2017), doi:10.1016/j.matdes.2018.06.013

Materials and Design (2018)

Contents lists available at ScienceDirect

Materials and Design

journal homepage: www.elsevier.com/locate/matdes

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

Paula GSaiz[1], Ana Catarina Lopes[1]*, Simone Eizagirre[1], Roberto Fernández de Luis[1], María Isabel Arriortua[1,2]

[1]BCMaterials (Basque Center for Materials, Applications & Nanostructures), Bldg. Martina Casiano, 3rd. Floor, UPV/EHU Science Park, Barrio Sarriena S/N, Leioa, 48940, Spain.

[2]Mineralogy and Petrology Department, University of the Basque Country (UPV/EHU), Barrio Sarriena S/N, Leioa, 48940, Spain.

ARTICLE INFO

Article history:
Received
Received in revised form
Accepted

Keywords:
Poly(vinylidene fluoride-co-hexafluoropropylene);
Modelling morphology;
Ionic liquids;
Membranes;
Mechanical properties;
Hydrophilic properties.

ABSTRACT

The development of polymer membranes with tailored micro-morphology and wettability is a demand in the areas of filtration, sensors, and tissue engineering, among others. The thermoplastic copolymer poly(vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP), is one of the most widely used polymers for these applications due to its good mechanical and thermal properties, biocompatibility and low density. Although the control of the PVDF-HFP morphology is a complicated task, the introduction of ionic liquids (ILs) in the PVDF-HFP matrix opens new perspectives in this area. This work consists of a systematic study of three different protic ionic liquids ([dema][TfO], [MIm][NTf_2] and [MIm][Cl]) in the control of PVDF-HFP membranes properties. Different preparation conditions are also analysed. These results demonstrate how several parameters such as morphology, water absorption capacity and mechanical properties vary depending on the production methodology employed and on the choice of incorporated IL. Pores of different sizes, spherulites and compact structures have been obtained, as well as hydrophilic and highly hydrophobic structures. These results show that ILs play a key role in the optimization of polymer properties and given the large number of available ILs, open up new possibilities for the development of polymer membranes suitable for applications where specific morphologies are desirable.

1. Introduction

Nowadays, the development of polymer membranes with tailored micro-morphology, mechanical properties or water absorption capacity is a demand in the areas of filtration, electronics, sensors, tissue engineering or energy, among others [1-3]. Morphology characteristics significantly determine the final mechanical, thermal, optical and electronic properties of membranes and for this reason, many efforts have been devoted to understanding how to control and tailor membrane morphology [4-7], as this could open new possibilities in the previously cited applications.

Some of the most commonly used polymers in membrane development are polyvinylidene fluoride (PVDF) and its copolymers. They are semicrystalline thermoplastic fluoropolymers with good physical and chemical properties, including good chemical and thermal stability, high polarity, low density, hydrophobic nature and biocompatibility [8]. Particularly, this family of polymers stands out for having the highest dielectric constant and the highest piezoelectric response among all the polymers. PVDF and its co-polymers are polymorphous polymers that can exhibit five crystalline phases, including two piezoelectric (γ and β-phases), which can be obtained by the control of the production method. The piezoelectric phases are widely applied in the area of sensors and actuators [9], as well as emerging applications such as the development piezoelectric scaffolds for tissue regeneration in biomedical applications [10].

* *Corresponding author.*
E-mail adress: catarina.lopes@bcmaterials.net