

Sujet de thèse CSC

Design of new innovative materials for improved dielectric properties

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In the last few years, the scientific community, including academic and industrial research, has put forward unprecedented efforts to develop new functional polymeric materials in terms of water or gas barriers, electrical, mechanical, fire retardancy, or self-healing properties. Very recently, ionic liquids (ILs) that are organic salts have demonstrated their great potential as new components of advanced polymer materials. Moreover, some materials have been developed on the basis of epoxy-thermoplastic systems and the first results obtained have been promising concerning dielectric properties and electrical breakdown [1,2]. In addition, ionic liquids have also been used as additives in epoxy-thermoplastic systems leading to co-continuous morphologies or phase inversions (Figure 1) resulting in significant increases in fracture toughness [3].

The aim of this PhD is to improve electrical properties of insulating polymer blends tailoring their morphology. It is well known that lamellar or fibrillar structures could affect the dielectric strength depending on its orientation inside the dielectric material. We propose to process first the thermoplastic into fibers and then processing the polymer blend (thermoplastic/thermoplastic blends and thermoplastic/thermoset blends). Controlling the shape of the thermoplastic, its orientation and the processing of the blend, anisotropic properties can be obtained. Ionic liquids will be used as interfacial agents to control the interface or to generate interphase between the two polymers. Morphology-property relationships will be developed to highlight the parameters for the improvement of the electrical properties.

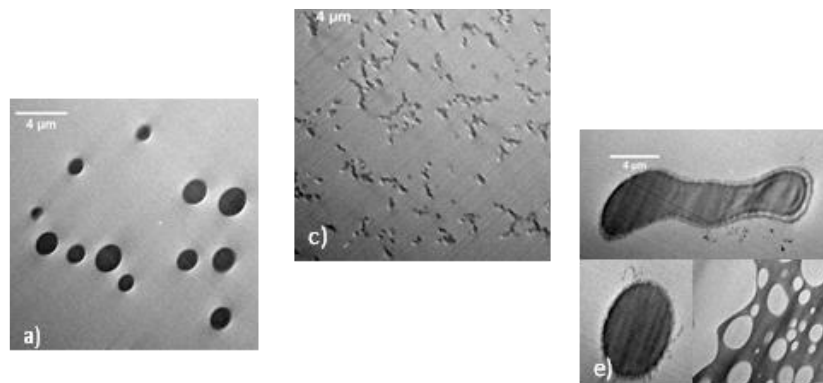


Figure 1: *Effect of ionic liquid on the morphologies of epoxy-thermoplastic system [3]*

[1] N. Halawani, J.L. Augé, H. Morel, O. Gain, S. Pruvost, *Composites Part B: Engineering*, 2017, 110, 530-541.

[2] N. Halawani, J.L. Augé, O. Gain, V. Griseri, G. Teyssède and S. Pruvost, *Polymer Degradation and Stability*, 155 (2018) 153-161

[3] T.K.L. Nguyen, S. Livi, B.G. Soares, H. Benes, J-F. Gérard, J. Duchet-Rumeau, *ACS Sustainable Chem Eng*, 2017, 5, 1153-1164.