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I N T E M A

Injected polymer blends and composites: processing-morphology-performance relationship

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Abstract

Many thermoplastic-composites are processed by an injection molding process. When dealing with semicrystalline polymers such as polyolefins, morphology is an important feature since it greatly affects thermal and mechanical performance of processed parts. The morphology of melt-crystallized polymers is known to be related to the fabrication technique. In composites and blends, morphology depends on factors such as the affinity and compatibility of the filler with the matrix, the matrix viscosity and the applied thermo-mechanical level, which depends on the processing conditions. The understanding of the fracture, microvoide formation and mechanics of composites and blends is crucial for engineers. In this work the relationship between processing and performance is reviewed for different injected thermoplastic pieces: polypropylene/clay nanocomposites, polypropylene/aluminum flakes microcomposites, and polypropylene/polyethylene blends. A complete characterization, including morphological and mechanical characterization is presented. Microstructure and morphology of materials were analyzed by differential scanning calorimetry (DSC), X-ray diffraction (XRD), and polarized optical microscopy (POM). Performance of pieces was evaluated by means of uniaxial and biaxial impact tests, and quasi-static fracture tests. The effects of the molding process and of the filler on the thermal, mechanical and fracture properties of the polymer composites are reported. Also, the effect of the occurrence of in-homogeneities, such as weld lines or flow lines in microstructure and therefore in performance are summarized.

Key words: Injection molding, polyolefins, nanocomposites, microcomposites, blends, mechanical properties, fracture behavior

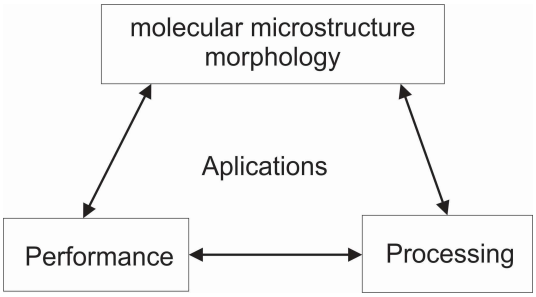


Figure 1. Relationship between processing, performance and morphology in injected polymer composites and blends.

Recent Publications

1. A Costantino, V Pettarin, J Viana, A Pontes, A Pouzada, P Frontini (2013) Morphology-performance relationship of PP-nanoclay composites processed by shear controlled injection moulding, Polym Int 62, 1589–1599
2. E Igarza, S Garcia Pardo, M Abad, J Cano, M Galante, V Pettarin, C Bernal (2014) Structure-fracture properties relationship for Polypropylene reinforced with fly ash with and without MAPP as coupling agent, Mater Design, 55, 85-92
3. M Costantino, V Pettarin, A Pontes, P Frontini (2015) Mechanical performance of double gated injected metallic looking polypropylene parts, eXPRESS Polym Lett 9(11) 1040–1051
4. B. Benaissa, N. Aït Hocine, I. Belaidi, A. Hamrani, V. Pettarin (2016) Crack identification using model reduction based on proper orthogonal decomposition coupled with radial basis functions, Structural and Multidisciplinary Optimization 54(2) 265-274
5. K. Aoudia, S. Azem, N. Aït Hocine, M. Gratton, V. Pettarin, S. Seghar (2017) Recycling of waste tire rubber: Microwave devulcanization and incorporation in a thermoset resin, Waste Management 60: 471-481
6. M.A. Costantino, F. Rueda, V. Pettarin, P.M. Frontini, A.J. Pontes, J.C. Viana (2017) Characterization of PP/TPV/MMT ternary nanocomposites produced by injection molding, Macromolecular Symposia 373: 1600153

Biography

VALERIA PETTARIN was born in Argentina in 1974. She graduated in Materials Engineering (1998) and received her PhD in Material's Science (2002) at the University of Mar del Plata. She is currently working as a Researcher at Institute of Materials Science and Technology in the Polymer Science and Engineering Group, and Professor at University of Mar del Plata. She made research stays at Politecnico di Milano (Italy, 2002 and 2007), Universidade de São Paulo, Universidade Federal do Rio de Janeiro (Brasil, 2003), Universidade do Minho (Portugal, 2009), and Friedrich-Alexander Universität Erlangen-Nürnberg (Germany, 2017). Her research interests lie on the experimental characterization and numerical simulation of mechanical, fracture and impact performance of polymer parts and its relationship with microstructure induced by the processing technology. She authored 35 indexed and 6 non indexed scientific publications, 5 book chapters and more than 80 works at International Conferences. She has also led several national and international research projects, and supervised several undergraduate, doctoral and pos-doctoral students.

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