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Correlation between morphology and processing parameters in polymer blends: preliminary results towards hierarchical structures

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Hierarchical polymer-based materials can be defined as blend characterized by a structural order at different scale levels. The system may be made of two or more polymers and a filler can be present. The increasing interest on these composites is due to the possibility to tune the morphology and, consequently, the properties of the overall system. In fact, several studies focus on the correlation of the morphological structure with the mechanical properties, the electrical conductivity, the permeability and the optical properties. One of the main issues related to hierarchical polymer refers to the production techniques. Traditionally, these systems are obtained via a bottom-up chemical approach. This brings along limitations such as the production of small batches and a non-negligible environmental impact due to the use of solvents. Another approach is the top-down production from the melt, as in the case of multilayer extrusion. In this case, the main issue is the restriction on the morphological freedom correlated to the structural constraints of the production tools. In the last years, another approach consisting in the bottom-up production from the melt has been increasingly studied. With this method, the inner morphology of the system develops during the blending or the forming step. The reciprocal arrangement is allowed by a combination of factor. Specifically, both processing parameters and materials features play an important role in the final morphology. It is important to note that the last approach associate the freedom in tuning the morphology proper of a bottom-up method and the benefits of a solvent-free in-line process. For the above reasons, the correlation between the inner morphology and the processing parameters (e.g. temperature, strain) for different polymeric systems is investigated. In particular, blends of bimodal polyethylene also with the addition of UHMWPE, homo and copo polyamides characterized by different viscosities have been studied.