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Rheological Properties and Foaming Behavior of Blends of Linear and Long-chain Branched Polypropylenes

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As the foaming process of polymers is strongly influenced by rheological properties of their melts, and especially by those in elongational flow, this paper focuses on the relationship between elongational properties and the foaming behavior. The foaming of conventional linear polypropylenes (L-PP) is restricted by their rheological properties, especially by the low melt strength, which leads to cell coalescence. New impacts on the foaming of polypropylene are generated by the development of high melt strength polypropylenes, such as long-chain branched polypropylenes (LCB-PP). In this paper the influence of blending different amounts of a long-chain branched PP to a linear PP on the rheological properties in elongational flow and the foaming behavior is investigated. In uniaxial elongational flow the addition of LCB-PP of less than 10wt.% already leads to a significant strain-hardening behavior. The strain hardening becomes more pronounced with growing LCB-PP content. In foaming tests with azodicarbonamide as chemical blowing agent an improved foaming behavior with regard to higher expansion ratio, lower amount of open cells and more homogeneous cell size distribution was found with increasing LCB-PP contents up to 50wt.%. This is attributed to a reduction of cell coalescence due to the higher resistance against rupture of cell walls caused by the increasing strain hardening. For the blends with 50wt.% LCB-PP and more a similar foaming behavior to that for the neat LCB-PP was found. These results indicate that blending already a low amount of a long-chain branched PP to a linear PP is an appropriate way to improve the foaming behavior of linear polypropylenes.