# Strategy to Produce High-Void Fraction in Microcellular Foamed Polyolefins

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## ABSTRACT

***In this research, a strategy to achieve high-void fractions in microcellular foamed polyolefins was investigated. The effects of batch processing conditions (time and temperature) and blend composition on the void fraction of microcellular foamed HDPE, PP and HDPE/PP blends were studied. Blending decreased the crystallinity of HDPE and PP in the HDPE/PP blends and facilitated microcellular foam production in blend materials. The void fraction of the foamed polymer blends was strongly dependent on the processing conditions: time (5, 10, 20 and 30 sec) and temperature (135, 160 and 175°C), and on blend composition. To achieve a high- void fraction, a foaming time of at least 20 seconds and a foaming temperature significantly above melting temperature were required. The blend ratio also affected the ability to achieve a high-void fraction.***

**Key words:** Microcellular foams, Polyolefin, Polymer blends

## INTRODUCTION

Microcellular plastics are characterized by cell densities in the range of 109 to 1015 cells per cubic centimeter, and cell sizes in the range of 0.1 to 10 micrometers. There are three major steps in producing microcellular foams, utilizing thermodynamic instability of a gas polymer system (Martini et al., 1984): 1) polymer/gas solution formation by saturating a polymer with a high-pressure gas, 2) microcellular nucleation and 3) cell growth and density reduction. In general, achieving a foam structure in a semi-crystalline polymer is relatively difficult compared to an amorphous polymer (Doroudiani et al., 1998). In this study, the effect of processing conditions (foaming time and foaming temperature) and blend composition on the void fraction in microcellular foaming of neat HDPE, PP and HDPE/PP blends was investigated. First, a variety of blend compositions were prepared using a twin-screw extruder. These materials were compression-molded into panels in a hot hydraulic press. Samples with differing blend compositions were then foamed, varying the foaming time and temperature and their void fractions compared.

Over the past decade, interest in the production of microcellular plastics has grown for several reasons. Compared to conventional foams in which weight reduction leads to reduction in mechanical properties, these materials exhibit enhanced impact strength (Dor-