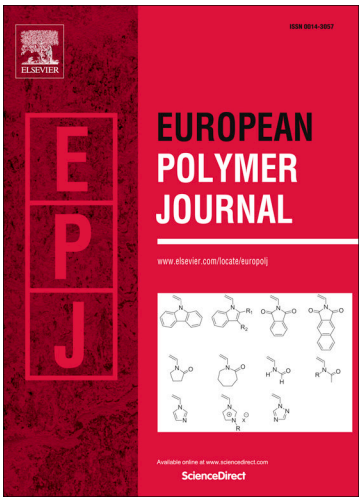

Role of nano silica in supercritical CO_2 foaming of thermoplastic poly(vinyl alcohol) and its effect on cell structure and mechanical properties

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Role of nano silica in supercritical CO_2 foaming of thermoplastic poly(vinyl alcohol) and its effect on cell structure and mechanical properties

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ABSTRACT:

Microcellular poly(vinyl alcohol) (PVA) foams were prepared by combing the thermoplastic processing technology and solid-state supercritical CO_2 foaming technology. The compound polyol plasticizers that may partially destroy intra- and inter-molecular hydrogen bonding within PVA and improve the flowability during processing were developed to pave the way for PVA thermoplastic processing with lower processing temperature and wider processing window. In order to ease the collapse of bubbles and improve the foaming performances, nano silica was introduced into the system. The influences of processing parameters (foaming temperature and saturation pressure) and nano silica content on the foaming behavior and cell structure were systematically studied. The resultant PVA/SiO_2 nanocomposite foams exhibited a cellular structure with smaller cell size, larger cell density and relative density compared to PVA foam. It was also found that cell density increased with decreasing foaming temperature or increasing saturation pressure. Further investigation suggested that improvement of stiffness as well as the decrease of crystallinity were thought as the main reasons to explain the interesting effect of SiO_2 addition on the foaming behavior of PVA.

KEYWORDS: Thermoplastic processing; Poly (vinyl alcohol) Foam; Nano silica; Supercritical Carbon Dioxide

1 INTRODUCTION

Polymeric foams have attracted wide interests ranging from industry to academic research due to their excellent properties containing lightweight, impact strength and thermal insulation. Commonly used polymeric foams are usually made from

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