Title:

Characterization of chemical composition distribution of ethylene-1-hexene copolymers, which form solution at room temperature

Main Author:

Name: Tibor Macko
Organization: Division Plastics, Fraunhofer Institute for Structural Durability and System Reliability
Country: Germany

Co-Authors:

Co-author 1: Subrajeet Deshmukh
Organization: Division Plastics, Fraunhofer Institute for Structural Durability and System Reliability
Country: Germany
Co-author 2: Jan-Hendrik Arndt
Organization: Division Plastics, Fraunhofer Institute for Structural Durability and System Reliability
Country: Germany
Co-author 3: Youlu Yu
Organization: Bartlesville Research Center, Chevron-Phillips Chemical Co., Bartlesville, 74004 Oklahoma
Country: USA
Co-author 4: Masud Monwar
Bartlesville Research Center, Chevron-Phillips Chemical Co., Bartlesville, 74004 Oklahoma
USA
Organization: Robert Brüll
Country: Division Plastics, Fraunhofer Institute for Structural Durability and System Reliability
Co-author 5: Germany
Organization:
Country:
Co-author 6:
Organization:
Country:

References:

Reference 1: Y. Yu, C.C. Tso, P.J. DesLauriers, Molecular characteristics of room-temperature soluble fractions of low-density polyethylene film resins. J. Appl. Polym. Sci. 100, 2006, 4992-5006.
Reference 2:
Reference 3:
Reference 4:
Reference 5:
Reference 6:
Reference 7:
Reference 8:
Reference 9:
Reference 10:
Reference 11:
Reference 12:

Images:

Images Guidelines: *Please provide maximum one, on a separate file (doc, pdf, tiff, gif, or bmap), and at a reasonable resolution.*

Abstract:

Note: maximum length of 400 words.

Linear low-density polyethylene (LLDPE) materials may contain components, which are soluble at room temperature [1]. These may influence physical properties or may migrate into the contents and thus represent a health risk because LLDPE is used widely for food packaging. Due to the nonpolar and amorphous character of that room temperature soluble part, its molecular characterization with common methods for polyolefin separation, such as TREF, CRYSTAF or DSC, has proven to be impossible or troublesome.

A selective separation of the amorphous part of LLDPE materials as well as their semicrystalline parts is, however, realizable with high-temperature liquid chromatography using porous graphite as stationary phase. This technique enables to evaluate the chemical composition distribution of both the room-temperature solubles and non-solubles in LLDPE samples.

It was found that LLDPE synthesized with metallocene catalysts contains only a very small amount of amorphous materials. In contrast, LLDPE prepared with Ziegler-Natta catalysts contained up to 14 wt. % of amorphous portion. The amorphous copolymers, which were soluble at room temperature, had a weight-average molar mass between 60 and 200 kg/mol and contained about 10 mol% more 1-alkene than the non-soluble part of LLDPE.

It is supposed [1] that the soluble macromolecules are linear, and that the branching points are almost regularly distributed, but only 7 – 11 carbons are between the branching points. It is not sufficient for the formation of lamellae at room temperature.