Title Gas transport properties of poly(n-alkyl acrylate) blends and modeling of modified atmosphere storage using selective and non-selective membranes

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Abstract

The gas transport properties of side-chain crystalline poly (*n* -alkyl acrylate) and poly (*m* -alkyl acrylate) blends are determined as a function of temperature for varying side-chain lengths, *n* and *m*, and blend compositions. The side chains of poly(*n* -alkyl acrylate)s crystallize independently of the main chain for $n \geq 10$ which leads to an extraordinary increase in the permeability at the melting temperature of the crystallites. The compatibility of these polymers are examined and macroscopic homogeneity is observed for a small range of *n* and *m* when the difference $|n - m|$ is between 2 - 4 methylene units. Thermal analysis shows that the blend components crystallize independently of one another; at the same time, the crystallization of each component is hindered by the presence the other component. The permeation responses of these blends show two distinct permeation jumps as the crystallites from each component melt at their respective melting temperatures. Blends with continuous permeation responses are found to have higher effective activation energies than observed for common polymers.

Thermal analysis proved to be a useful tool to help predict the permeation response for poly(alkyl acrylates); thus the thermal behavior of poly(*n* -alkyl acrylate) blended with n-aliphatic materials and random copolymers of poly(*n* -alkyl acrylates) are briefly examined.

A bulk modified atmospheric storage design is proposed where produce is stored in a rigid chamber that is equipped with both selective and non-selective membrane modules that help regulate the oxygen entering and the carbon dioxide leaving the produce compartment. The design enables control of the atmosphere inside the chamber by modulating gas flow, i.e. the gas flow rate and composition, through the non-selective membrane by delivering fresh air upstream of the non-selective membrane. The model shows that the choice of materials for the selective and non-selective membranes dictate the range of concentrations achievable; however, the air flow rate allows the control between these ranges. The method to design a practical chamber from this model is also described.