

SOLUBILITY OF MULTIPLE GASES IN AMORPHOUS POLYPROPYLENE

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The sorption equilibrium in gas-phase catalytic copolymerization of α -olefin plays a key role in the polymerization rate and polymer properties.^[1] Individual and total solubilities of multiple penetrants (i.e., propylene, ethylene, propane, and their mixtures) in different types of polypropylene (PP) (i.e., isotactic PP, iPP, and random copolymers of propylene with ethylene, RCP) are measured at industrially relevant conditions (i.e., temperature of 75 °C and 85 °C, and pressure range of 0 – 25 bar) using a pressure decay method. The measured solubility results showed that the total and individual solubilities of gases in amorphous PP increased with an increase in pressure and a decrease in temperature. It was found that solubilities of propylene and propane in amorphous iPP were quite similar due to their similarity in molecular structure. The solubility of propylene in the amorphous phase of RCP was found to be four to five times higher than that of ethylene and was slightly higher in amorphous RCP than in amorphous iPP. In the ternary system of propylene (1) / propane (2) / iPP (3), propylene acts as an anti-solvent to propane, and vice versa for propane to propylene, resulting in lower solubility than in the respective binary cases. The co-solubility effect of propylene on ethylene as well as the anti-solvent effect of ethylene on propylene was also exhibited for the ternary system of propylene (1) / ethylene (2) / RCP (3). The obtained solubility results are correlated with the Sanchez-Lacombe equation of state (SL EoS model)^[2] to determine temperature-dependent binary interaction parameters (k_{ij}).

References

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