

GAS PHASE ETHYLENE POLYMERIZATION: WHAT IS THE INFLUENCE OF CONDENSED MODE

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For a technology considered mature by many academics, there remains a considerable number of unresolved problems in the field of olefin polymerization on supported catalysts. Recent work has shown that a detailed understanding of the thermodynamics of sorption and diffusion of multicomponents are key points, and that mastering these process-related aspects will allow us to better control the end-use properties of these important parameters. This poster will provide a number of examples where an understanding of thermodynamics can lead to a far better understanding of the impact of the process on the polymerization and polymer properties. We will focus on the impact of adding inert alkanes (called induced condensing agents, ICAs, which are widely used in commercial processes – but not often in academic laboratories – to promote heat removal) on production rates and molecular weight distributions. Particular attention will be paid to the consideration of co-solubility effects in multicomponent systems, as well as to experimental methods allowing their evaluation at pressures and temperatures used industrially.

It turns out that the co-solubility effect, where the concentration of a lighter species in the amorphous phase of the polymer is increased by the presence of a heavier hydrocarbon, is very important for homo- and copolymers. For example, in the case of ethylene + 1-butene copolymerization, the addition of an alkane such as n-pentane can increase the concentration of ethylene in the polymer (and therefore at the active sites), resulting in an increase in ethylene incorporation. This leads to a higher polymerization rate, and a higher ethylene content in the copolymer. Similar effects were also observed for diffusion.