

Improvement of comonomer incorporation due to temperature variation in the heat treatment of Ziegler Natta catalysts

Lukas Göpperl¹, Paul Aigner¹ and Christian Paulik¹

¹ Institute for Chemical Technology of Organic Materials, Johannes Kepler University, Linz

Conclusion

The variation of temperature during titination in the formation of a Ziegler Natta catalyst revealed an interesting possibility to influence the copolymerization behavior of ethylene with higher α -olefins. The activity rate is increased and simultaneously, the incorporation rate of the comonomer is influenced towards a more homogeneous profile over the entire chain length distribution (Fig. 1). This incorporation behaviour is highly beneficial, because it is not a typical property of Ziegler Natta catalysts [1].

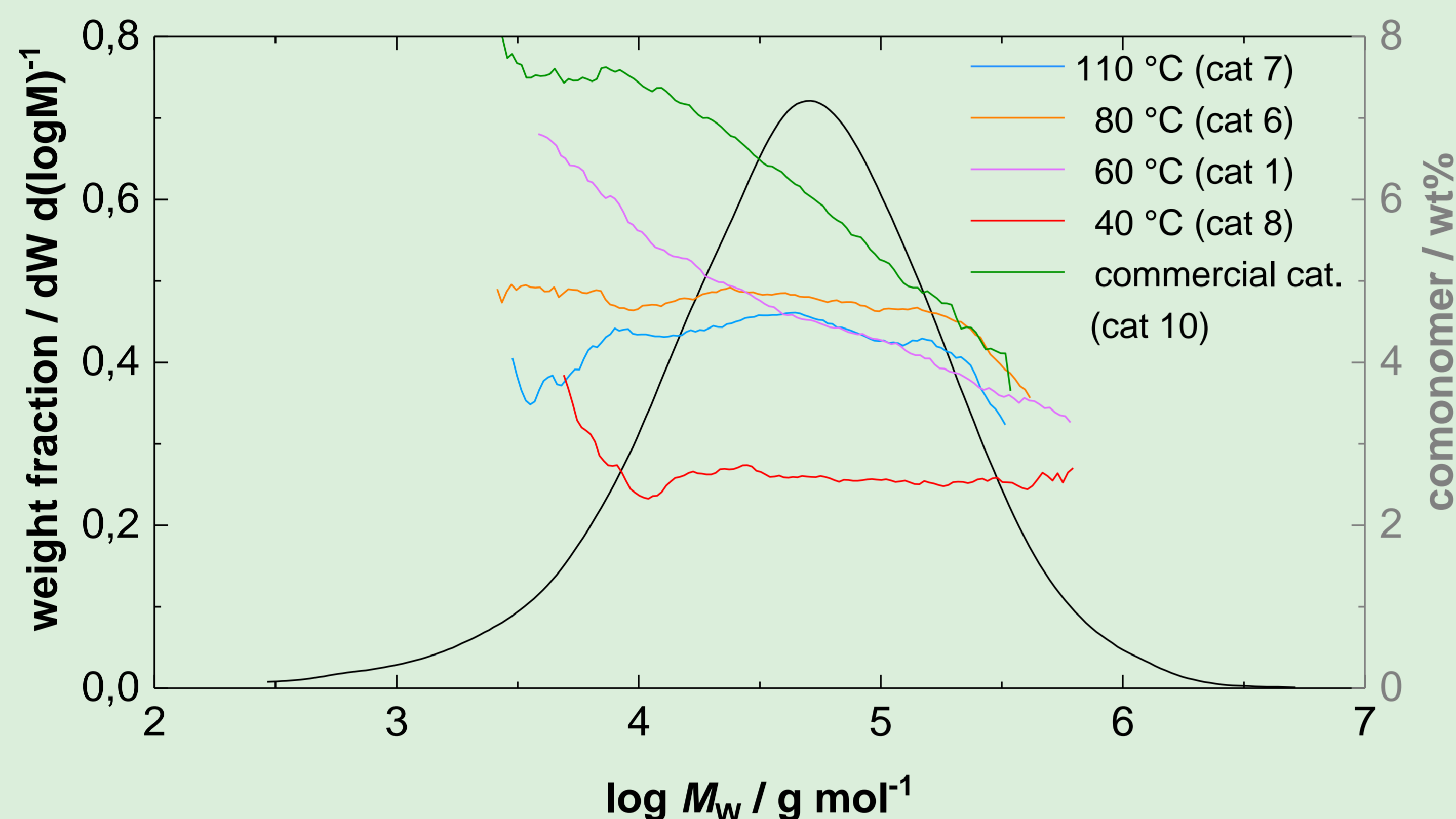


Figure 1: Influence of different temperatures during the titination step on the incorporation of the comonomer.

Introduction

Since its discovery, polyethylene (PE) has become one of the most important polymers in the entire polymer sector. One of the increasingly important groups of PE is linear low density polyethylene (LLDPE).

Most of the LLDPE is produced by Ziegler Natta catalyzed processes. However, a disadvantage of these catalyst systems is the uneven incorporation of the comonomer over the entire chain length distribution (Fig. 1).

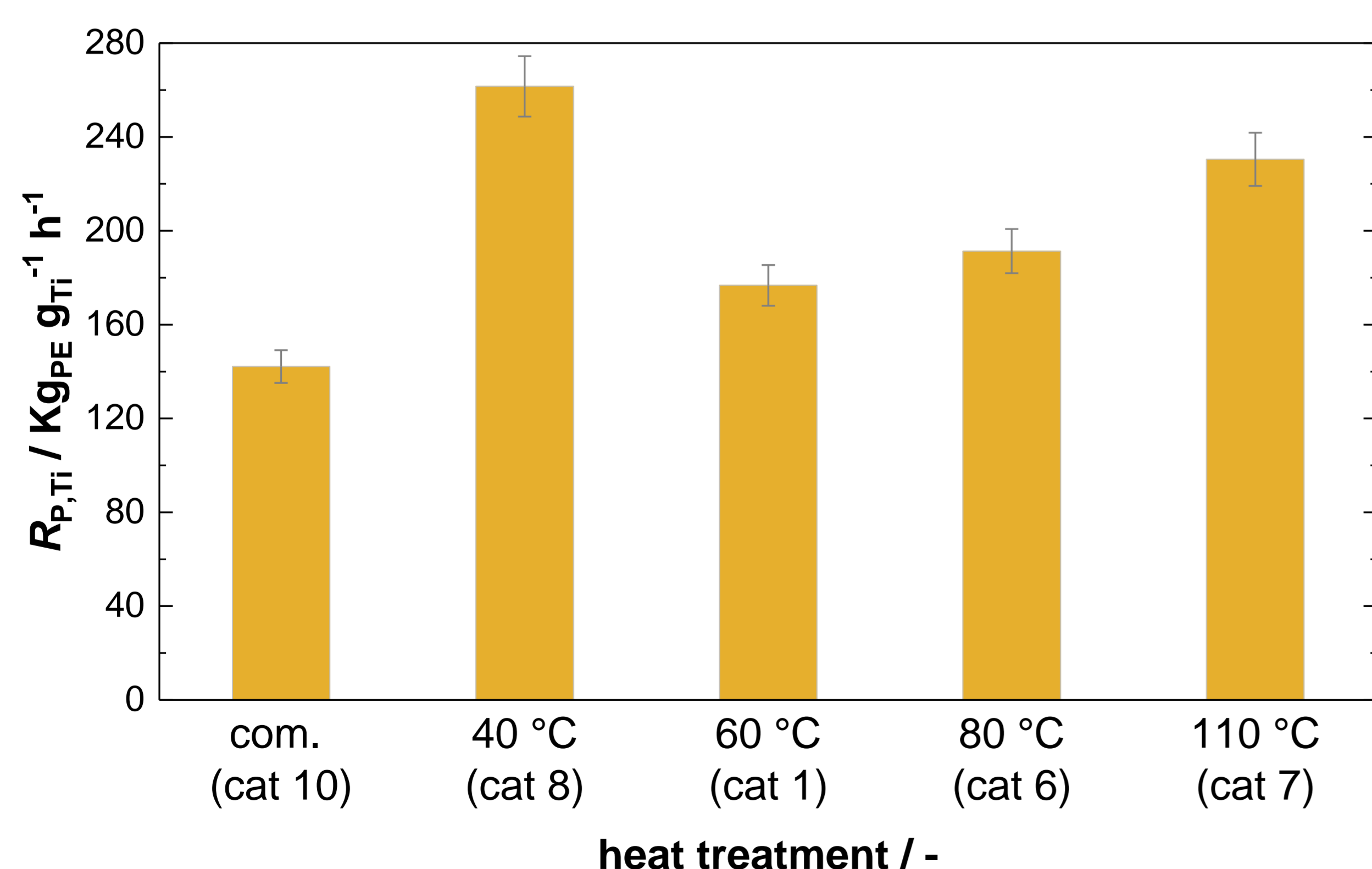


Figure 2: Comparison of the catalysts with various titination temperatures in terms of the polymerization rate R_p .

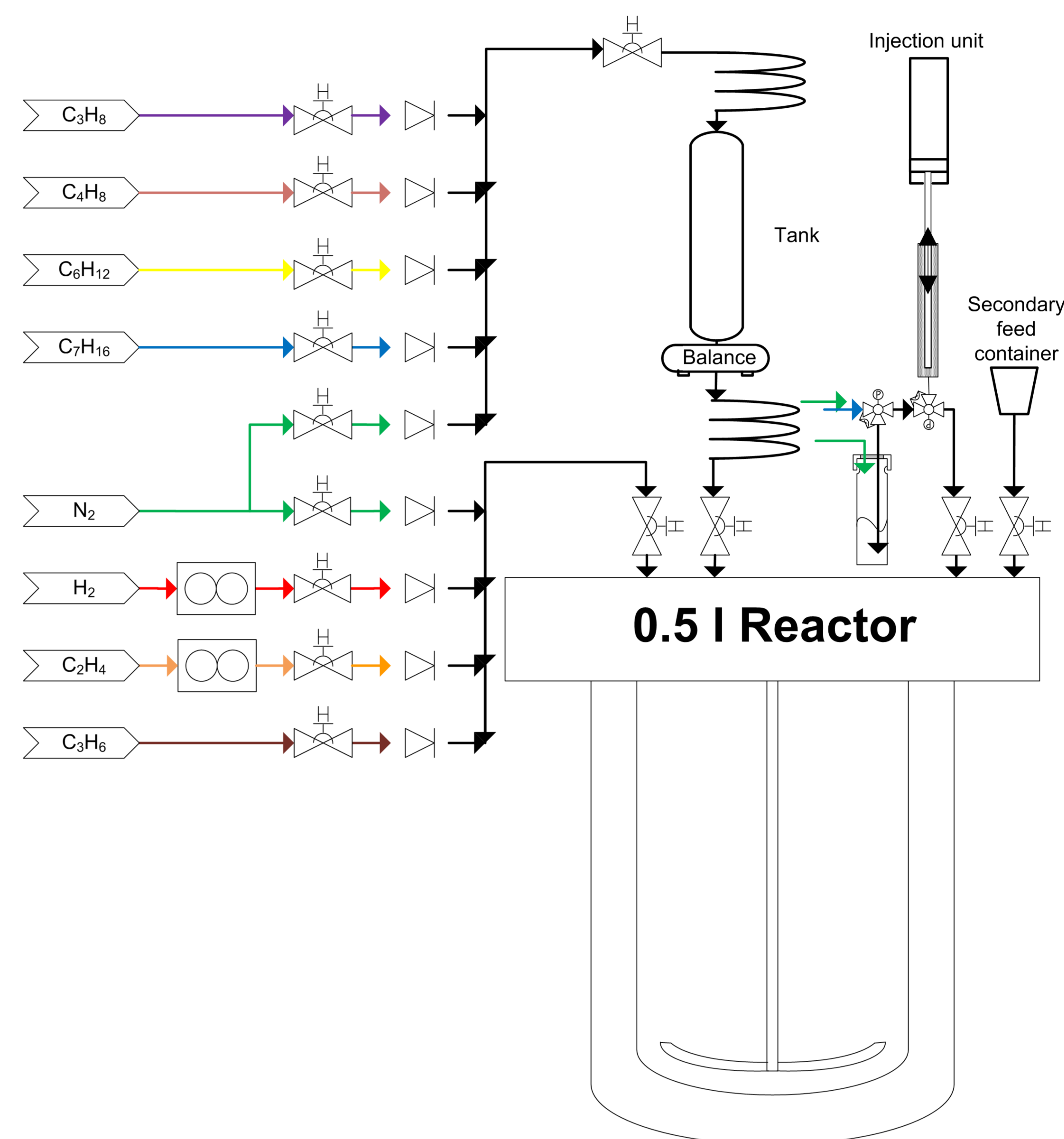


Figure 3: Schematic drawing of the 0.5 l polymerization reactor system.

Experimental

The $MgCl_2$ supported Ziegler Natta catalysts were prepared in two steps. The $MgCl_2$ carrier is formed in the first step followed by the titination yielding the Ziegler Natta catalyst. During titination, the temperature was varied between 40 - 110 °C.

All catalysts were tested in copolymerization experiments in a 0.5 l reactor system (Fig. 3). The product properties of the LLDPE were analyzed by SEC and DSC.

Results

Variation of the process parameters during catalyst production showed, that the properties of the synthesized catalyst can be influenced. Thus, varying the titination temperature has the greatest impact. By increasing the temperature during the titination step, the polymerization rate is increased and a more uniform incorporation of the comonomer is achieved.

The catalyst produced at 40 °C shows by far the most uniform incorporation of the comonomer and also achieved the highest activity rate (Fig. 2). Currently investigations concerning the relationship between catalyst formation and comonomer distribution are ongoing.

About the author

Currently, Lukas Göpperl is working as a PhD student in the field of polymer reaction engineering. His focus lies on the development of Ziegler Natta catalyzed polymerization processes.

