

# Melting-point and crystallinity of polyethylene wax produced by different alkylaluminum co-catalysts

Alexander Mottl, Christian Paulik

Institute for Chemical Technology of Organic Materials, Altenbergerstraße 69, 4040, Linz, Austria

## Theoretical background

The polymerization of olefins using ZN catalysts is a fundamental process in the production of various plastics. These catalysts typically comprise titanium tetrachloride ( $\text{TiCl}_4$ ) along with aluminum alkyls serving as co-catalysts. The role of these alkyls is crucial, as they are responsible for reducing the catalyst and facilitating the formation of active centers ( $\text{C}^*$ ) that drive the polymerization process. Factors like the type of co-catalyst, its concentration, and the specific reaction conditions all play crucial roles in determining the final properties of the PE wax.<sup>1</sup> In this study, the effects of different co-catalysts on PE wax were examined, with a particular focus on melting point and crystallinity.

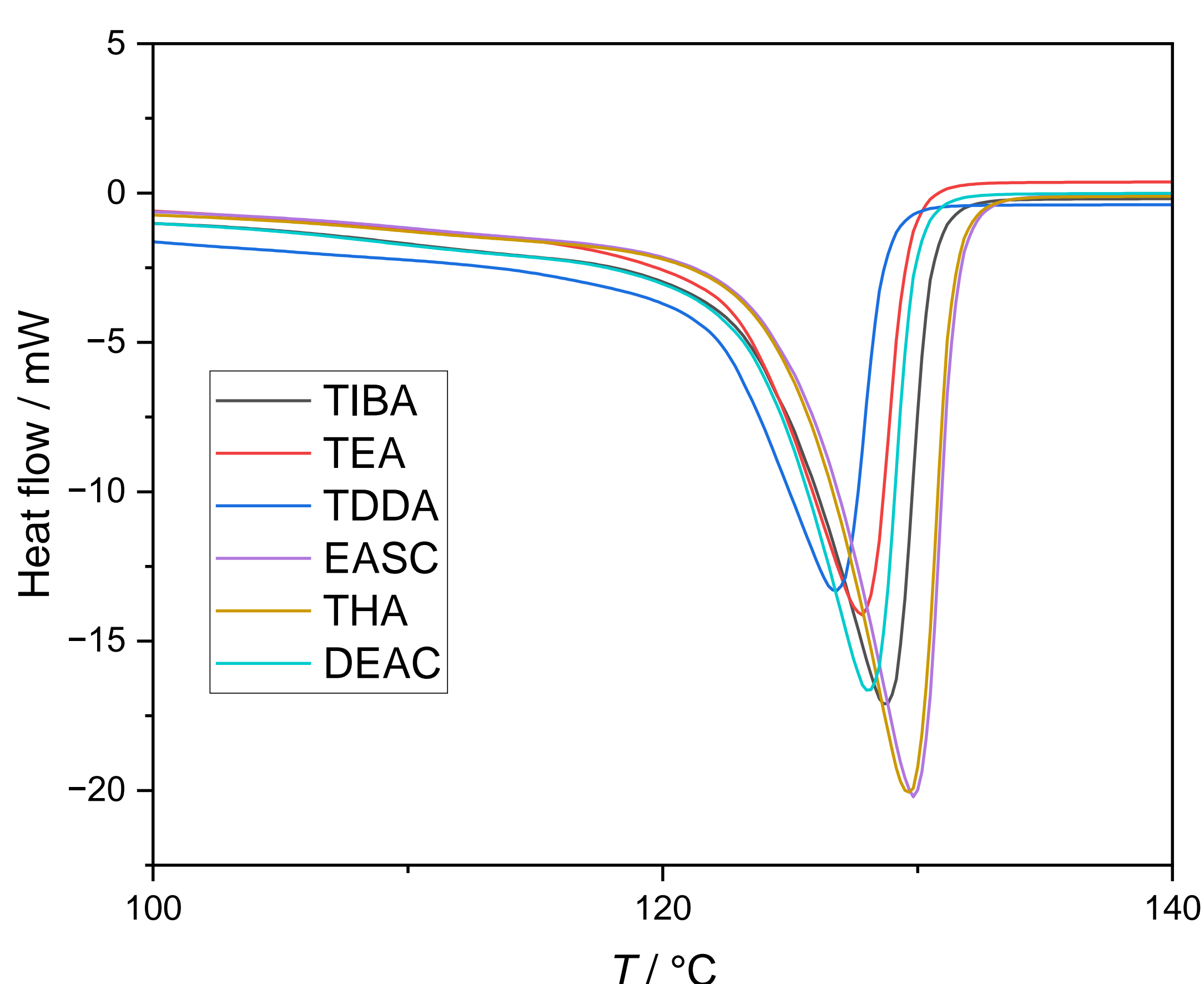


Figure 1. Melting points of PE wax samples produced with different co-catalysts.

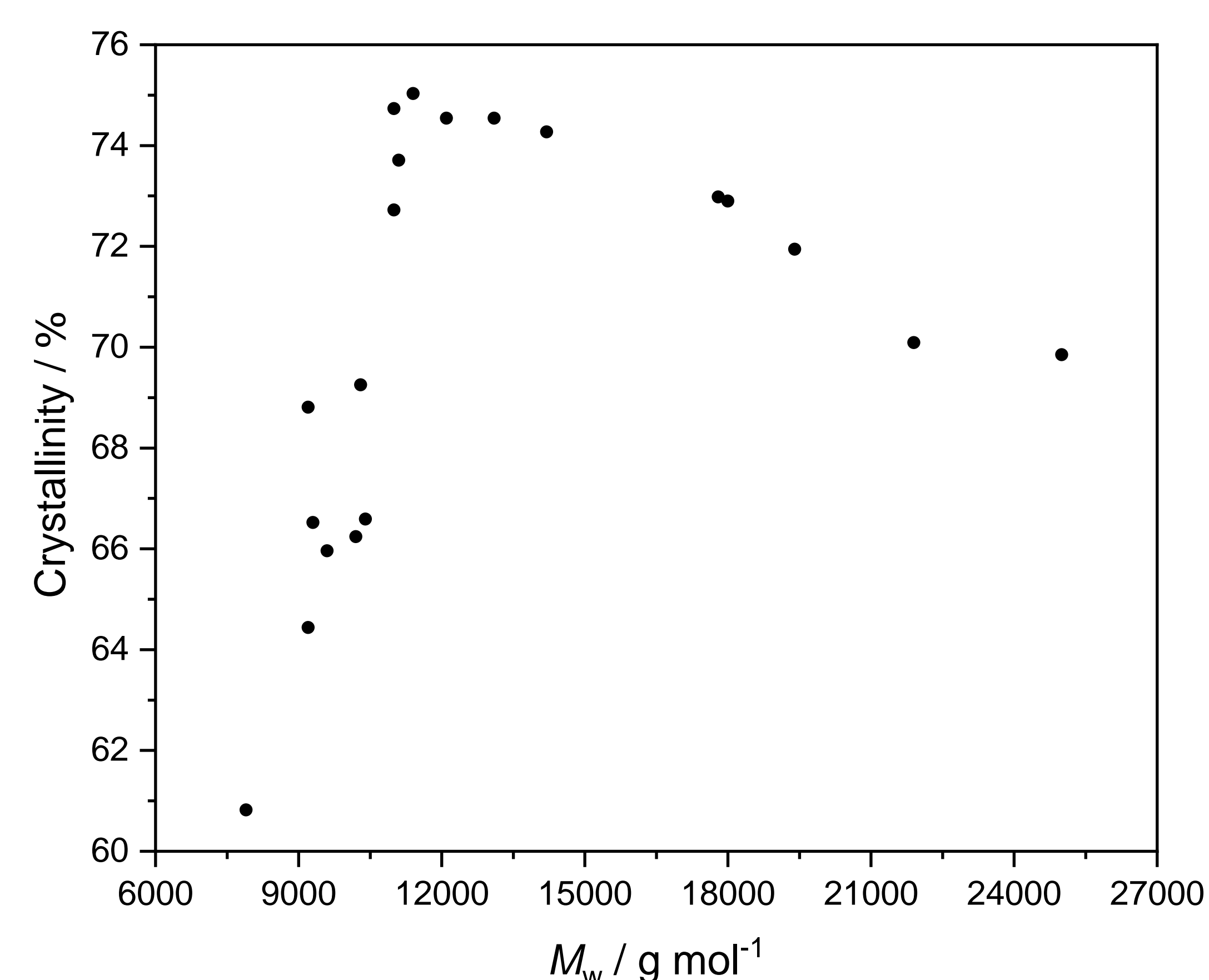
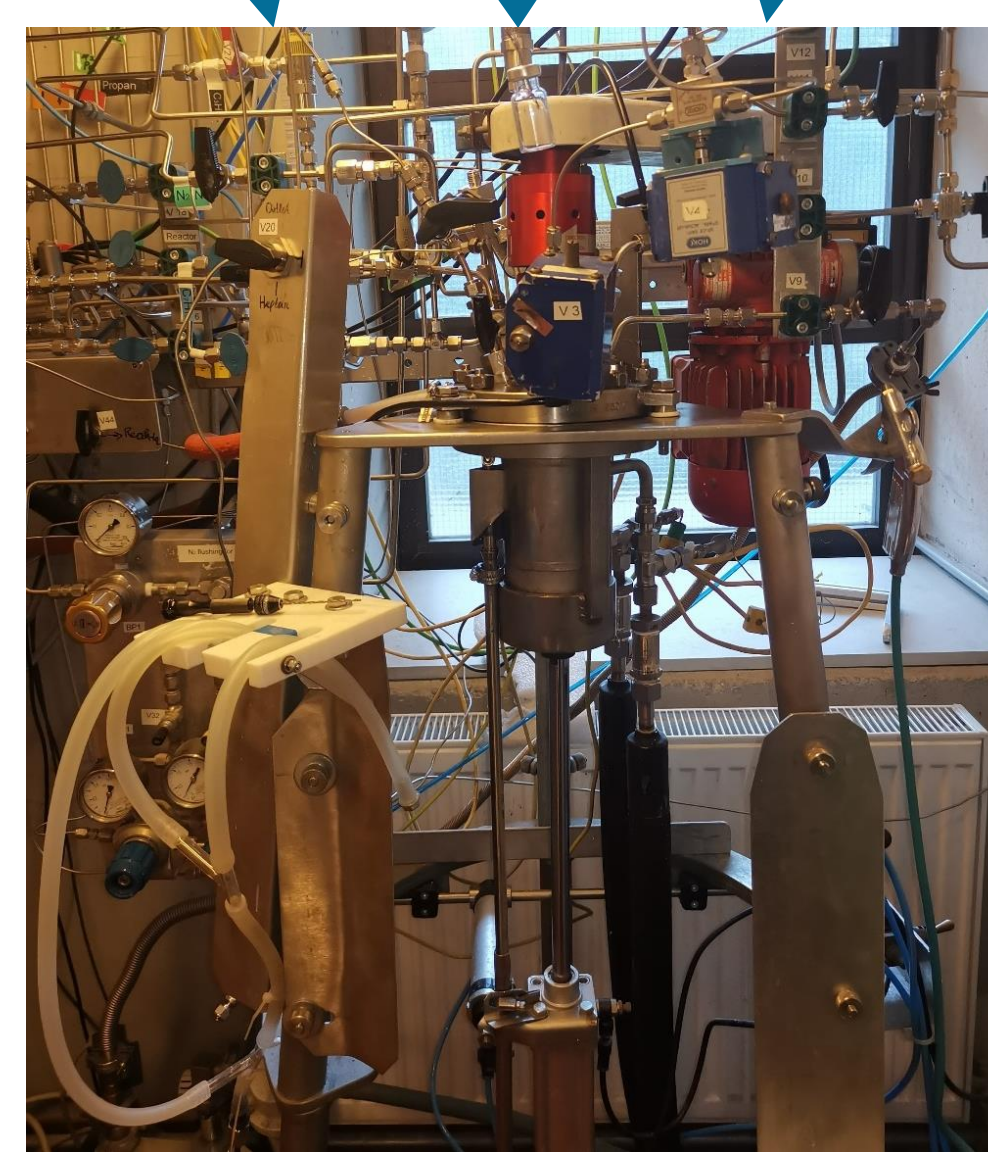


Figure 2. Crystallinity obtained from the DSC measurement is plotted against their  $M_w$ .

## Results

Each measurement yielded slightly different values for crystallinity and melting point. This lack of consistent correlation between co-catalyst choice and thermal properties as depicted in Fig 2. suggests that other factors, beyond co-catalyst selection, influence these results.<sup>2</sup> The observed variability in crystallinity and melting points stems from differences in the molecular weights of the PE waxes. Examining Fig 3. reveals that the crystallinity reaches a maximum at a molecular weight of approximately 12000  $\text{g mol}^{-1}$ .

## Conclusion

A connection between crystallinity and  $M_w$  was observed, indicating that as these molecular parameters vary, there is a corresponding impact on the crystalline structure of the polymer. Furthermore, a maximum in crystallinity for semi-industrial polyethylene could be observed. However, no apparent correlation was found between the type of co-catalyst used and the thermal properties of the resulting polymer. This suggests that the choice of co-catalyst does not directly affect the crystalline properties.

## Alexander Mottl

Currently working as an PhD student in the field of polyolefines.



## References

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2. Krumme, A.; Lehtinen, A.; Viikna, A. *Eur. Polym. J.* **2004**, *40*, 371–378.