

# Characterization of complex Ethylene-Propylene copolymers. A journey inside the analytical techniques.

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The characterization of Polypropylene copolymers and in particular the heterophasic resin, is a challenging task. These resins are usually reactor blends with:

- non homogeneous ethylene incorporation into the PP chain covering the full range of ethylene incorporation
- stereoregularity variations
- a broad molar mass range
- a complex composition molar mass interdependence

The analysis of these polymers demands a great effort in separation technology followed up by characterizing the obtained homogeneous fractions by spectroscopic techniques; another option is the use of sophisticated hyphenated separation techniques. Given the compositional difference of the polymer molecules in these resins, the separation must be performed based on composition rather than on molar mass.

In the first part of the talk the principles of the various separation techniques are investigated and results discussed in view of the peculiarities of the polyethylene and polypropylene combination.

The attained information is used in the second part of the presentation to better interpret the analytical results obtained by cross fractionation methods of complex PP copolymers using crystallization or adsorption separation in the first dimension followed by molar mass separation in the second dimension. The use of infrared detection with composition sensor provides an extra dimension that is very valuable in the analysis of resins containing PE and PP components.

## References:

1. Monrabal, B., Polyolefin Characterization: Recent Advances in Separation Techniques. In *Polyolefins: 50 years after Ziegler and Natta I*, Kaminsky, W., Ed. Springer Berlin Heidelberg: **2013**; Vol. 257, pp 203-251.
2. Monrabal, B.; Romero, L., Separation of Polypropylene Polymers by Crystallization and Adsorption Techniques. *Macromolecular Chemistry and Physics* **2014**.
3. Monrabal, B.; López, E.; Romero, L. *Macromolecular Symposia* **2013**, *330*, 9.
4. Macko, T.; Pasch, H. *Macromolecules* **2009**, *42*, 6063.
5. Cong, R.; deGroot, W.; Parrott, A.; Yau, W.; Hazlitt, L.; Brown, R.; Miller, M.; Zhou, Z. *Macromolecules* **2011**, *44*, 3062.
6. Ginzburg, A.; Macko, T.; Dolle, V.; Brüll, R. *European Polymer Journal* **2011**, *47*, 319.
7. Cheruthazhakkatt, S.; Pijpers, T. F. J.; Harding, G. W.; Mathot, V. B. F.; Pasch, H. *Macromolecules* **2012**, *45*, 2025.