LIÈGE université
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Recherche & Innovation

gesval s.a.

Block Copolymers of Ethylene and Vinyl Monomers

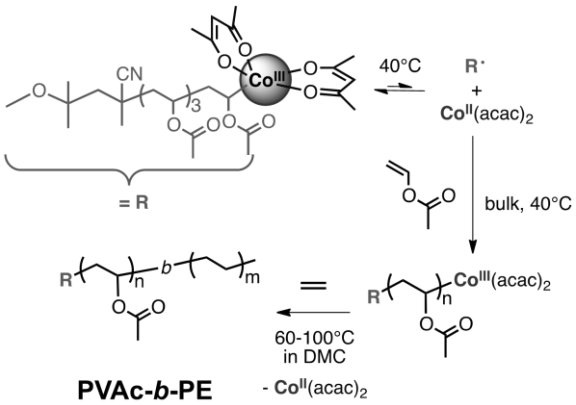

Figure 1 : Synthesis scheme for PE-b-PVAc block copolymer

Polyethylene is the most important polymer produced world-wide (> 100 MT/year) that finds numerous applications from packaging to high added value products.

Productions of homo-polyethylene and some random copolymers, such as ethylene-propylene rubber or ethylene vinyl acetate (EVA) are industrially well-known and are commonly carried out by catalytic coordination insertion (e.g. Ziegler Natta or Phillips catalysis) or by free-radical polymerization techniques.

Block copolymerizing ethylene with vinyl monomers is however less obvious and remains a real challenge, especially for polar monomers.

The present technology relates to a new process to manufacture block copolymers made of a polyethylene block and a block formed by the polymerization of polar vinyl monomers such as vinyl esters, N-vinyl amides, (meth)acrylates, (meth)acrylamides, acrylonitrile, etc.

KEY COMPETITIVE ADVANTAGES

- Enable the synthesis of block, random and gradient copolymers made of ethylene and polar vinyl monomers
- Work at low (<50 bar), medium and high pressure.
- Work at low temperature (<100°C)
- Polymers with controlled molecular weight
- Polymers with low dispersity (PDI < 1.5)
- Block copolymers can be used as compatibilizing agents, surfactants, dispersants ...

KEY ACHIEVEMENTS

The synthesis proceeds by a controlled radical polymerization process using a cobalt complex as controlling agent (*Cobalt Mediated Radical Polymerization - CMRP*). This process enables to control the growth of the polymeric chains during the polymerization allowing thereby a good control over the molecular weight and the final structure of the copolymers.

The process is particularly adapted for the production of poly(ethylene)-*block*-poly(vinyl acetate) (PE-*b*-PVAc) (see Figure 1) and its hydrolyzed product, poly(ethylene)-*block*-poly(vinyl alcohol) (PE-*b*-PVOH), or for the preparation of poly(ethylene)-*block*-poly(N-methyl vinyl acetamide) (PNMVA-*b*-PE).

Figure 2 shows gel permeation chromatograms (GPC) of two examples of block copolymers obtained by the present CMRP method: a PE-*b*-PVAc block copolymer with a *Mn* = 12.6Kg/mol and PDI = 1.25 (left) and a PNMVA-*b*-PE block copolymer with a *Mn* = 12.6Kg/mol and PDI = 1.25 (right); PNMVA = Poly-*N*-Methyl-*N*-VinylAcetamide.

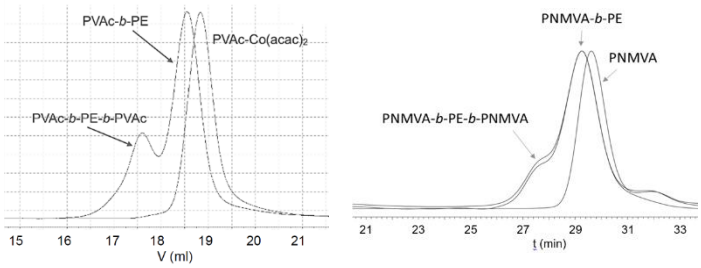

Figure 2 : GPC of a PE-b-PVAc (left) and of a PNMVA-b-PE (right) obtained by CMRP.

INTELLECTUAL PROPERTY

- Patent application pending : WO2019121409

PARTNERSHIP SOUGHT

- Licensing agreement
- R&D collaboration

CONTACT

ULiège Interface Entreprises
Jean-Marc Schumers, TTO
jm.schumers@uliege.be

CERM Research Group
Christophe Detrembleur, inventor
christophe.detrembleur@uliege.be

www.enmieux.be

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