



**GRAFT POLYMER**  
COMBINE INCOMPATIBLE

**GP SOLUTIONS FOR  
RECYCLING  
MARKET**

# PRODUCTS for RECYCLING MARKET

The increase in awareness and care about the environment and healthy living has inspired many industries to use green and sustainable solutions. It has led to an increase in demand for recycled plastics across the world.

Graft Polymer Ltd. has a range of products for recycling market:

Compatibilizers for Scrap

Melt Flow regulator for PP

Melt Flow enhancer for PE

Chain extenders for polycondensation scrap



# GP PRODUCTS for SCRAP from DIFFERENT SOURCES

**Source №1:** post-industrial scrap (tubes, containers etc.)  
**Base:** polyolefin scrap based on PP and PE

- 1. Compatibilizers for mixed polyolefin scrap:**
  - GRAFTABOND™ PP-MAH 100025 CA (coupling agent for fillers and tensile strength increase)
  - GRAFTABOND™ EP-MAH 04770 IM (regulation of impact resistance)
  - Custom-made compatibilizers (based on scrap composition)
- 2. Masterbatches for melt flow regulation for PP (with peroxide):**
  - GRAFTALEN™ MB PO-DCP - 3%, 5% & 10% (peroxide concertation)
  - GRAFTALEN™ MB PO-H05 (Granules) – peroxide free
  - GRAFTALEN™ MB PO-BIIB - 5% & 10% (peroxide concertation)
  - GRAFTALEN™ MB PO-DTBP– 5% & 10% (peroxide concertation)
- 3. Melt low enhancer for PE**
  - GRAFTALEN™ SA (powder)

**Source №2:** post-consumer scrap (mainly plastic bottles)  
**Base:** polyester scrap based on PET, PBT, PC

- Chain extenders for polycondensation scrap:**
- GRAFTALEN™ 168 CE (powder)
  - GRAFTALEN™ EB 15050 CE (Granules)
  - GRAFTABOND™ EB-GMA 15020 CE (Granules) - for polyesters and polyester based compounds

**Source: №3:** post-industrial & post-consumer scrap (wrapping and other films, containers etc.)  
**Base:** LLDPE with contaminations, inc. EVOH

- Compatibilizers:**
- GRAFTABOND™ LL-MAH 00220 C
  - GRAFTABOND™ EBA-MAH 00330 C

**Source №4:** post-industrial & post-consumer scrap (cabels)  
**Base №1:** LDPE with contaminations SEBS, EPDM  
**Base №2:** PVC

- Base №1 (LDPE) – the same products as for Source №1**
- Base №2 (PVC)**
- 1. PVC Compatibilizer:**
    - GRAFTABOND PVC – MAH: Compatibilizer for PVC compounds with polar polymers
  - 2. PVC Modifiers:**
    - GRAFTABOND PVC – BA
    - GRAFTABOND PVC – VA
    - GRAFTABOND SB – MMA (improves shock resistance and frost resistance)
    - GRAFTABOND EV – MMA (modifier of the hardness for rigid PVC)
    - GRAFTABOND CPE/MBS/ABS/SEBS – GMA (Impact modifiers)
  - 2. Product for reducing flame propagation in plasticized PVC:**
    - GRAFTASYNT GB-RDP\*

# Compatibilizers for Scrap

We determined the effectiveness of using combination polyolefin scrap compatibilizers GRAFTABOND™ PP-MAH 10025 CA and GRAFTABOND™ EP-MAH 04770 IM with post-consumer PO recycle and with post-consumer PP recycle.



Post-consumer PO recycle



Post-consumer PP recycle



Property	Units	No compatibilizer	+ 2% GRAFTABOND™ PP-MAH 10025 CA  + 3% GRAFTABOND™ EP-MAH 04770 IM	+ 2% GRAFTABOND™ PP-MAH 10025 CA  + 5% GRAFTABOND™ EP-MAH 04770 IM
Max. Tensile Stress	MPa	20,3 ±0,3	19,2 ±0,6	18 ±0,4
Elongation at Break	%	11,2 ±0,9	18,7 ±2,4	24,0 ±2,0
Charpy Impact Strength	kJ/m <sup>2</sup>	4,1 ±0,8	8,3 ±1,2	11,1 ±1,0

Property	Units	No compatibilizer	+ 2% GRAFTABOND™ PP- MAH 10025 CA  + 3% GRAFTABOND™ EP- MAH 04770 IM	+ 2% GRAFTABOND™ PP- MAH 10025 CA  + 5% GRAFTABOND™ EP- MAH 04770 IM
Max. Tensile Stress	MPa	25,3 ±0,3	24,3 ±0,6	23,2 ±0,4
Elongation at Break	%	12,1 ±0,9	14,2 ±2,4	18,4 ±0,5
Charpy Impact Strength	kJ/m <sup>2</sup>	5,1 ±0,8	6,2 ±1,0	7,9 ±1,0

# Compatibilizers for Scrap



## GRAFTABOND™ LL-MAH 00220 C

LLDPE based **compatibilizer** for virgin & recycling polyethylene compounds and blends

- Most useful for mixed films recycling
- Dosage 2-3 %

## GRAFTAKIT™ ECO 00750 C

Reactive masterbatch, designed to greatly **improve mechanical properties** of mixed polyolefin scrap

- Most useful for PP/PE scrap mixtures
- Dosage 1-5 %

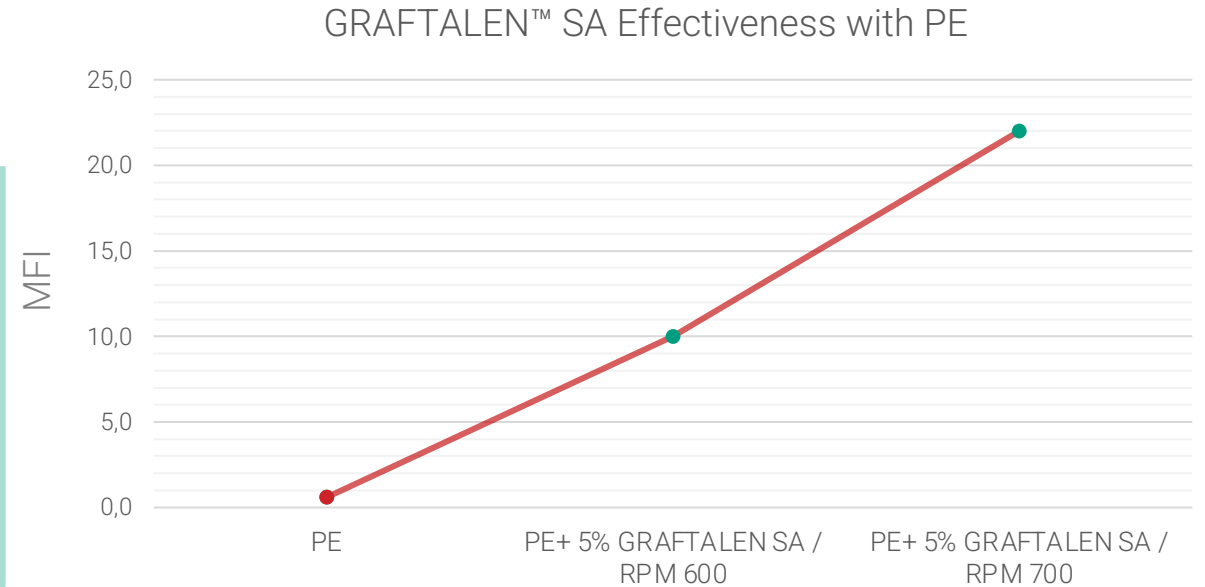
# Melt Flow **enhancer** for PE

## GRAFTALEN™ SA (powder)

Additive for polymers, used for regulating rheological properties

Dosage 0.5-5% during processing

No crosslinking effect on PE

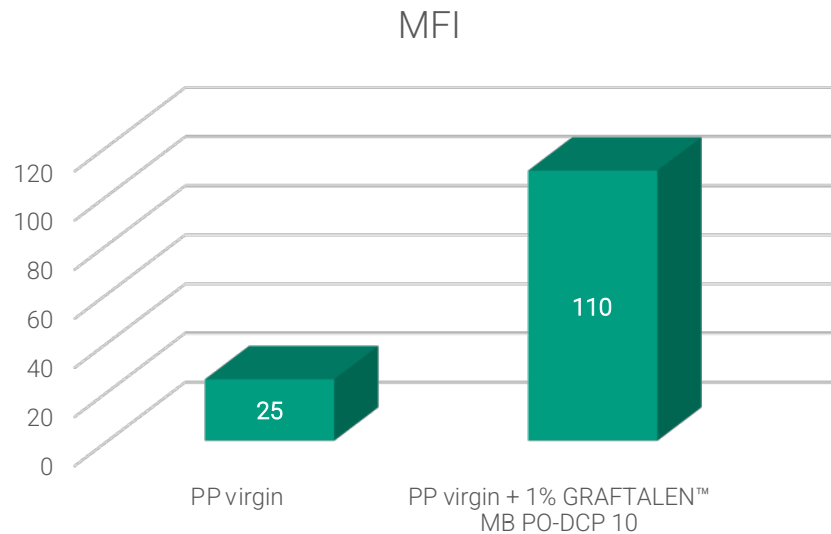
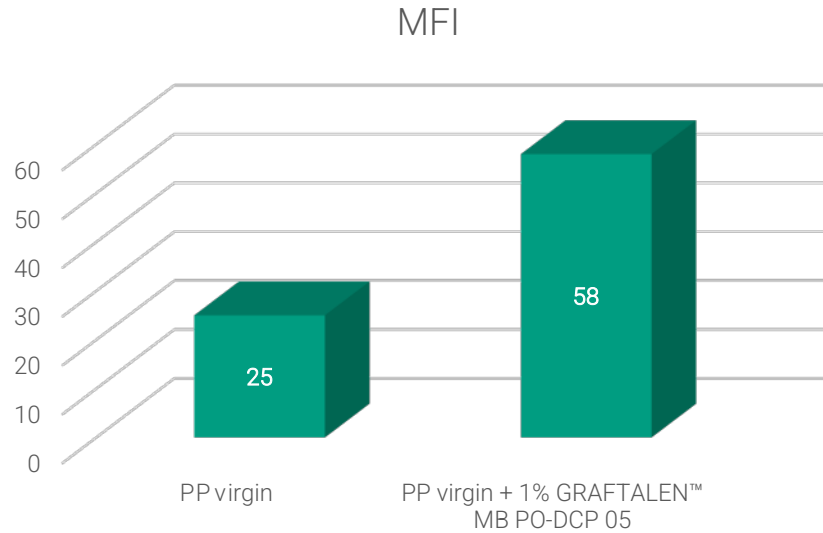


The effectiveness of GRAFTALEN™ SA is increased by using the proper temperature profile:



Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	Die
Temp. [°C]	60	130	200	220	350	350	350	350	350	220	220	200	180	180

# Melt Flow regulators for PP



GRAFTALEN™ MB PO-DCP 03 – 3% peroxide concentration

GRAFTALEN™ MB PO-DCP 05– 5% peroxide concentration

GRAFTALEN™ MB PO-DCP 10– 10% peroxide concentration

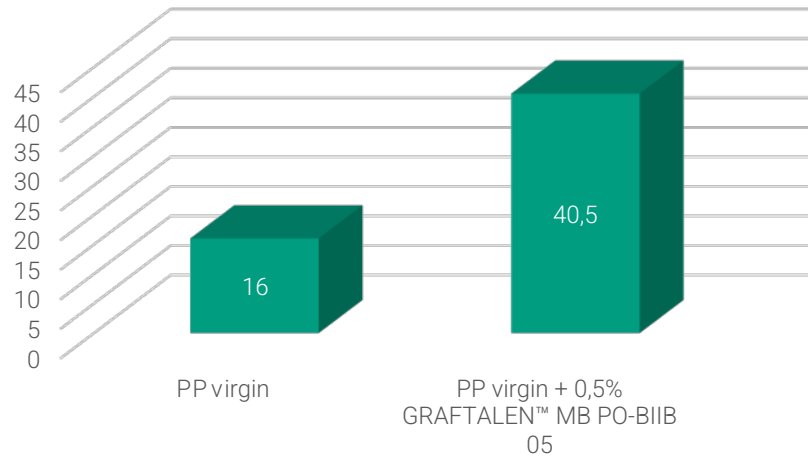
GRAFTALEN™ MB PO-H05 (Granules) – peroxide FREE

All these products designed to **increase melt flow of PP and PP compounds** (scrap/virgin)

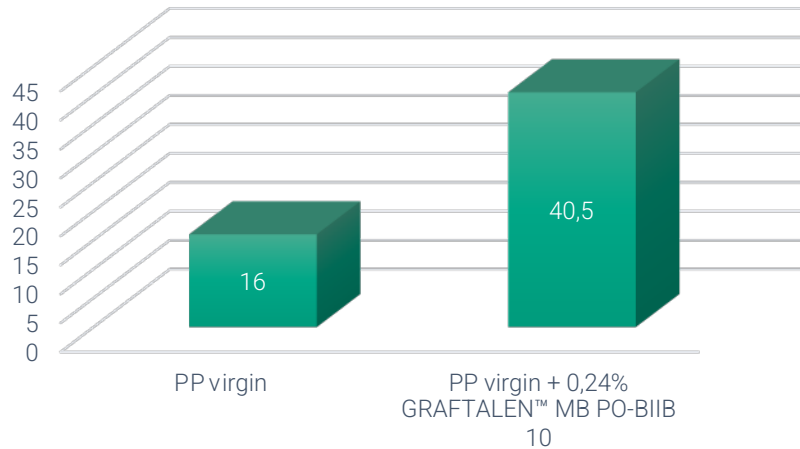
Can be used to decrease the MFI of the PE compounds

# Melt Flow regulator for PP

MFI



MFI



GRAFTALEN™ MB PO-BIIB 05 – 5% peroxide concentration

GRAFTALEN™ MB PO-BIIB 10 – 10% peroxide concentration

All these products designed to **increase melt flow of PP and PP compounds** (scrap/virgin)

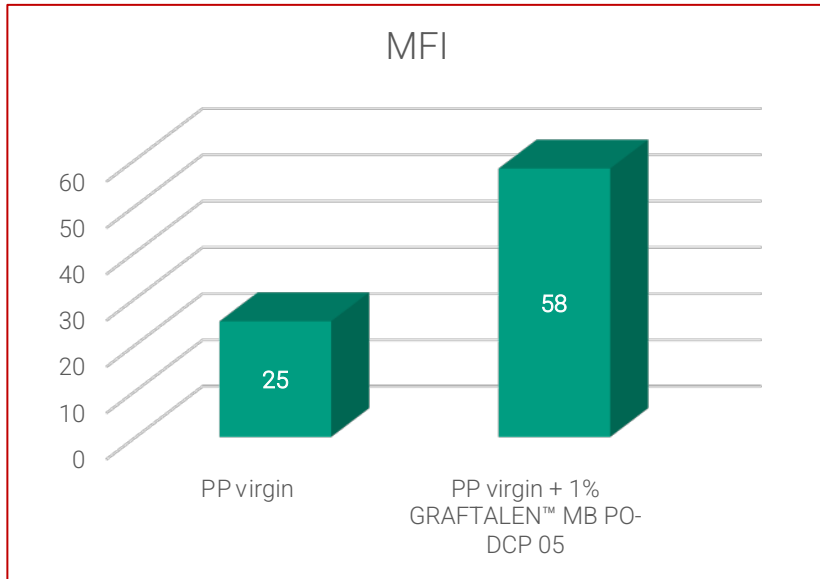
Can be used to decrease the MFI of the PE compounds

Advantages:

- ✓ NO odour
- ✓ LOW dosage
- ✓ Cost effective



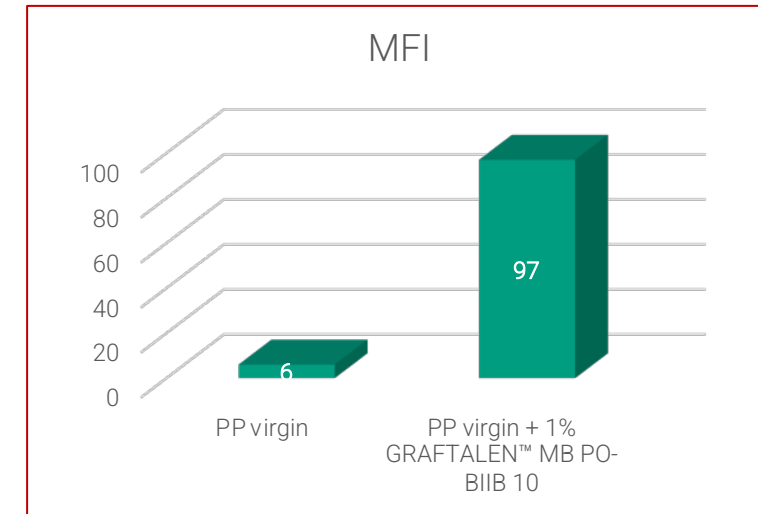
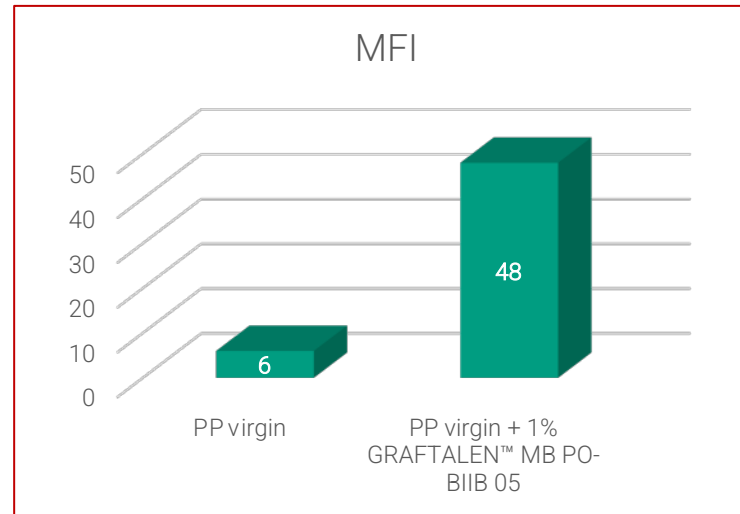
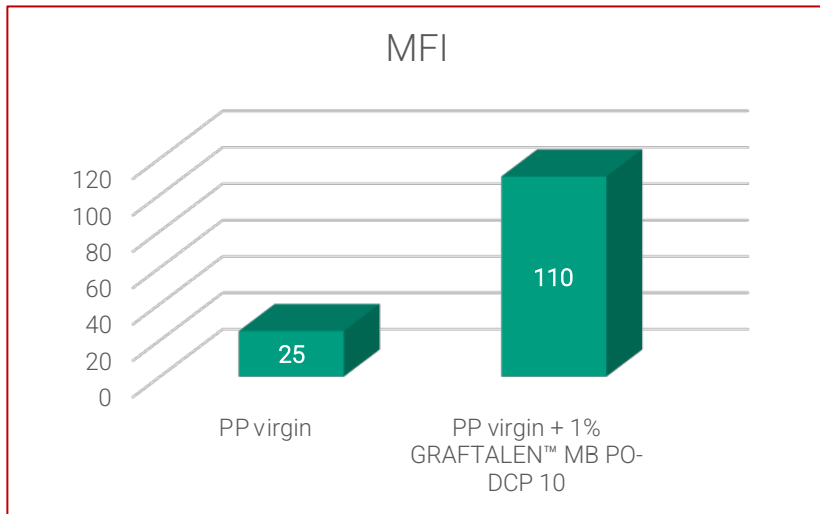
# Melt Flow regulator for PP



GRAFTALEN™ MB PO-DCP – 3%, 5% & 10% (peroxide concentration)  
GRAFTALEN™ MB PO-H05 (Granules) – peroxide free  
GRAFTALEN™ MB PO-BIIB - 5% & 10% (peroxide concentration)  
GRAFTALEN™ MB PO-DTBP– 5% & 10% (peroxide concentration)

All these products designed to increase melt flow of PP and PP compounds (scrap/virgin)

Can be used to decrease the MFI of the PE compounds

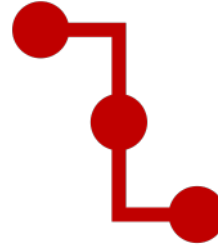


# Chain extender for polycondensation scrap PET, PBT, PC, PLA

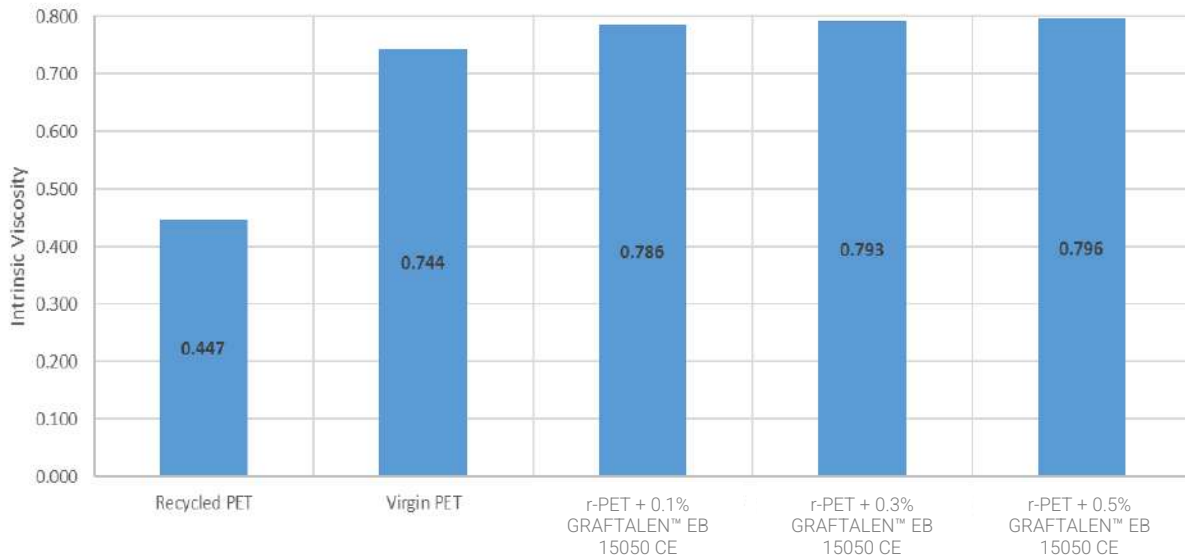
Additives help revitalize recycled polycondensation polymer and increase its molecular weight to the same or even higher molecular weight than virgin:

GRAFTALEN™ EB 15050 CE (Granules)  
Dosage 0.3-0.5 %

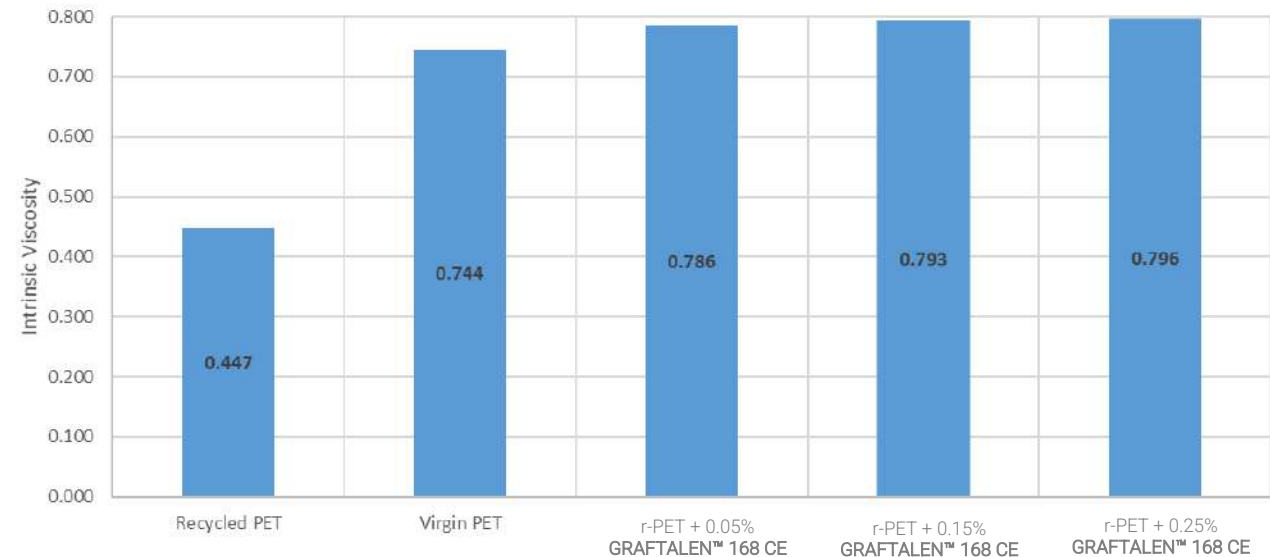
GRAFTALEN™ 168 CE (Powder)  
Dosage 0.05-0.3 %



Intrinsic Viscosity of PET



Intrinsic Viscosity of PET

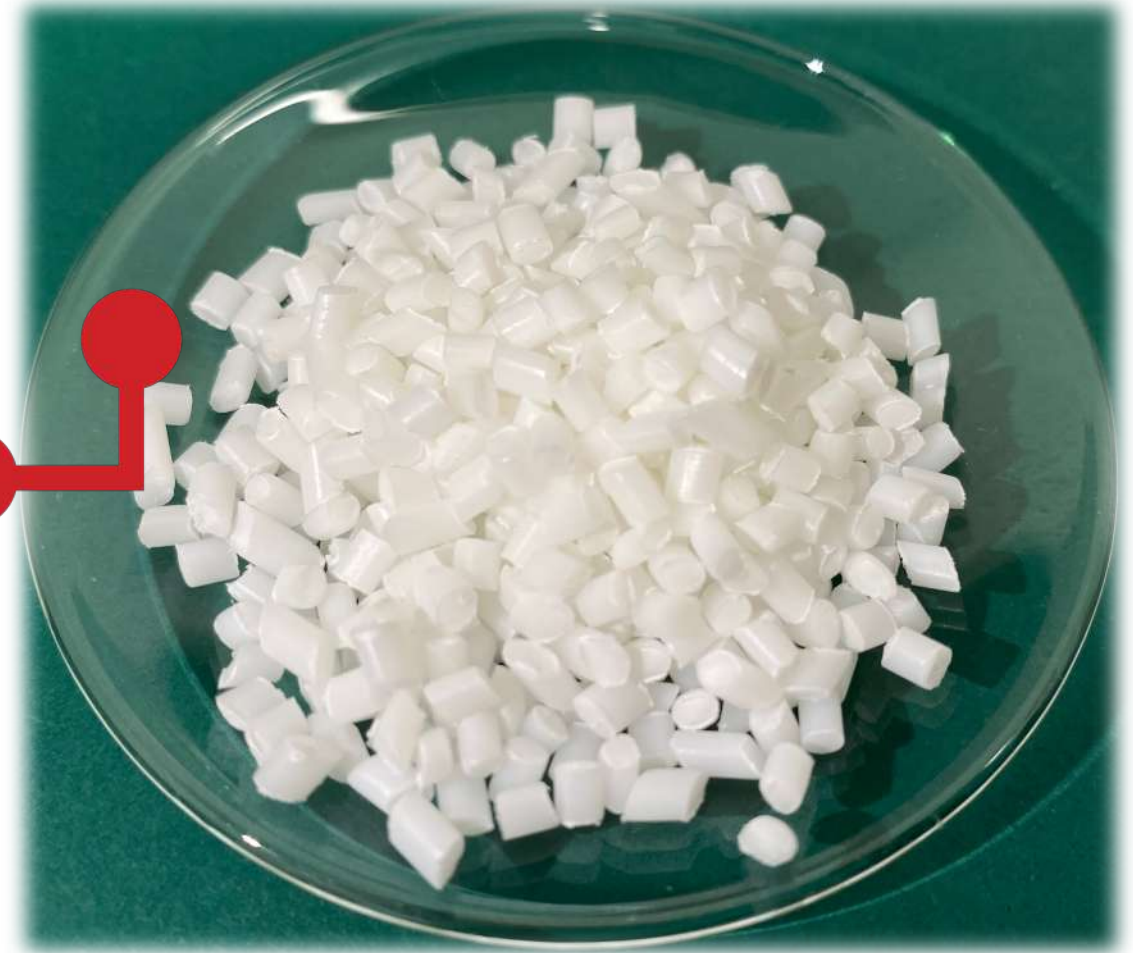


# CHAIN EXTENDER FOR POLYESTERS & POLYESTER BASED COMPOUNDS

## GRAFTABOND EB-GMA 15020 CE (Granules)

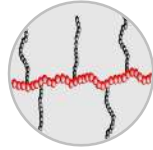
It adds **flexibility** and **good low temperature behavior** to the base material. The high grafting degree adds additional functionality as a **chain extender** for polyesters and polyester based compounds.

**Dosage 1-5 %**



# BUSINESS MODEL: INNOVATIONS

**GRAFT / BLOCK POLYMERS**



**POLYMERIC NANO ALLOYS**



**CROSSLINKING**



**POROUS**



**SYNTHESIS**



## INNOVATIVE TECHNOLOGIES

- Flow induced crystallization
- Solid Phase Grafting
- Solution Grafting
- Fillers Treatments
- Powders Hybridization
- Hot ozonolysis/plasma modification
- Nitroxide Mediated Polymerization
- Micro/Nano Porous polymer carries

To support its unique modification technologies, GP has built the R&D center including **Laboratory** and **Synthesis facilities**



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## Contact information

**Anjeza Kuhar** | Sales Manager  
English / Italian / Albanian  
Phone: +386 40 380 668  
anjeza.kuhar(at)graftpolymer.com

**Pavel Kobzev** | English / Hebrew  
Business Development & Sales Director  
Phone: +386 40 867 937  
Pavel(at)graftpolymer.com

**Ekaterina Kulevskaia** | Sales Manager  
English / Russian / Slovenian  
Phone: :+386 31 399 366  
ekaterina(at)graftpolymer.com

[www.graftpolymer.com](http://www.graftpolymer.com)

[Info\(at\)graftpolymer.com](mailto:Info(at)graftpolymer.com)