PVC
PVC MODIFIERS & PRODUCTS BENEFITS
2020
INTRODUCTION

Since PVC has a high polarity and high compatibility with a variety of other high-performance plastics, it is possible to mix these easily to form polymer alloys. By polymer alloying techniques some of the shortcomings of rigid PVC products can be modified.

Modified PVC used in a wide range of applications as follows: exterior building materials (window frames, siding), industrial boards, impact-resistant waterproof tubes, packaging of rigid PVC (blistering, caps-covers, bags), protective films, electrical parts (connectors).
IMPACT RESISTANCE

Generally, to improve the impact resistance of PVC products, impact modifiers (toughening agents) that have rubber-like properties such as ABS, MBS, acrylic rubber, chlorinated polyethylene, or EVA, are mixed with PVC.

Sufficient impact resistance for practical use can be obtained by blending 5~20 weight parts of these impact modifiers to 100 weight parts of PVC.

The impact modifier in the form of microparticles is dispersed within the molecular structure of PVC. When the PVC products receive an impact, these microparticles in the molecular structure absorb the impact energy and prevent damage to the PVC product.

PVC whose impact resistance is modified is used in a wide range of applications including exterior construction materials (window frames, siding), industrial boards, impact-resistant water pipes, rigid PVC packaging (blister packs, caps, casings), surface protecting films, or electrical parts (connectors).
HEAT DISTORTION TEMPERATURE (SOFTENING TEMPERATURE)

In order to enhance the heat resistance, heat distortion temperature or softening temperature of PVC products, heat resistant resins such as ABS resins, α-methylstyrene copolymers, or after chlorinated PVC are usually blended in.

Fig.3 and Fig.4 show the improvement of the softening temperature by blending ABS as an example, and the improvement of thermal deformation temperature by blending after chlorinated PVC, respectively.

PVC with enhanced heat resistance is used for heat resistant rigid PVC pipes, such as hot water supply pipes or electric cable protecting tubes, and instrument panels of vehicles.

On the other hand, soft PVC products with modified heat resistance can be manufactured by blending with a high-polymer plasticizer. Such products are used for heat resistant cable covering and other applications.
PREVENTION OF PLASTICIZER BLEED AND VOLATILIZATION

In order to prevent bleeding, volatilization or migration of plasticizers to other materials from soft PVC products, plasticizers with high molecular weight or high compatibility with PVC are adopted.

Picture shows an example where a polyester plasticizer with a molecular weight of 1,500 is used to replace DOP, which is a general-purpose plasticizer with a molecular weight of 390. Test pieces are placed in an oven of 160 °C and rates of weight loss are measured to represent volatilization of plasticizers as time elapses.

On the other hand, plasticizer free flexible PVC products are manufactured as in the case of graft polymerized EVA (ethylene vinyl-acetate copolymer) and PVC, or a terpolymer composed of ethylene-vinyl acetate-carbon monoxide.

PVC including plasticizers which do not migrate or bleed at high temperatures is used for electric/electronic parts and heat resistant cables. Some of the non-migrating type plasticizers are used for medical bags/tubes or industrial hoses.
GRAFTABOND PVC – MAH: Compatible for PVC compounds with polar polymers

GRAFTABOND PVC – BA:
- Internal plasticization, resistance to UV and heat resistance
- Improves shock resistance and frost resistance
- Improves Processability
- Excellent weather resistance

GRAFTABOND PVC – VA:
- Increases the resistance to UV and heat resistance
- Improves shock resistance and frost resistance
- Lamination of aluminum profiles of steel

GRAFTABOND SBS – MMA: Improves shock resistance and frost resistance
  Prevents the migration of liquid plasticizers

GRAFTABOND EVA – MMA: most effective modifier of the hardness for rigid PVC
  Non-migrant, non-volatile and Ecological

GRAFTABOND CPE/MBS/ABS/SEBS – GMA: Impact modifiers
GRAFTASYNT HFFR

Flame retardant liquid additive based on Boron Chemistry, designed to reduce flame propagation in polymer compounds (PA, TPU, PET, PBT, PC, PVC) or coating system.

GRAFTASYNT HFFR is efficiently to use in soft PVC with 40-50% of plasticizer, where the flame redundancy is subsided.

- Achieve V-0 rating at low loading levels
- For Thermoset and Liquid polymeric systems
- Dosage 5-15%

NO effect on color COST-EFFECTIVE
WHAT MAKES GP UNIQUE

- Use **proprietary co-agents** and **redox initiating system** for grafting
- Use of **Nitroxide Mediated Polymerization** for controlled grafting reactions
- **Co-continuous nano-morphology** approach for creation polymeric alloys
- **Interpenetrating Polymer Networks (IPN)**
- **Thermo-Reversible Crosslinking polymers** and **Vitrimer**s
- **Smart Polymers**
  - **Self-Healing** polymers
- In-house synthesis of unique “**nitroxide stable radicals**” (TEMPO) for high-tech composite materials – proprietary process
To support its unique modification technologies, GP has built the R&D center including Laboratory and Synthesis facilities.

**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

**GRAFT / BLOCK POLYMERS**

**POLYMERIC NANO ALLOYS**

**CROSSLINKING**

**POROUS**

**SYNTHESIS**
Contact information

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

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

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

www.graftpolymer.com
Info(at)graftpolymer.com