

PLUSS[®]



Pluss Polymers is an offshoot of Manas, established to develop and market new technologies and products developed inhouse. Pluss Polymers was incorporated in 1993 to commercialise the technology for grafted modified polymers and alloys and blends. Backed by competent technical staff, laboratory facilities, a good library and technical database with a retrievable wealth of information marketed the OPTIM[®] brand of grafted polymers for the first time in India in 1996.

OPTIM[®] coupling agents and compatibilisers allow plastics manufacturers of world class quality products to *OPTIMise* their compound properties. The ADNYL[®] range of nylon alloys provide the user with extra tough nylon for increased strength.

Profiles and other rigid and flexible containers for thermal energy storage have also been introduced in India for the first time by Pluss Polymers.

FILLED PP COMPOUNDS FOR HIGH PERFORMANCE

Polypropylene is no longer filled with calcium carbonate, clay or talc merely to reduce the cost. If properly dispersed, mineral fillers could contribute towards increasing hardness, abrasion resistance, strength, heat distortion temperature; reducing shrinkage during moulding and improving paintability and appearance of the end product. Developments in equipment, materials and techniques have thus led to availability of PP compounds which pose a challenge to engineering plastics in applications demanding a high performance to cost ratio.

The higher level of properties is achieved by:

- Increasing the filler loading.
- Improved interfacial adhesion between filler and polymer matrix.
- Blending with impact modifying polymers.

References in literature claim that Maleic Anhydride (MAH) and Acrylic Acid modified PP along with other additives when added to mineral filled PP compounds at 1-5% level increase the tensile strength. The same level of addition increases the Heat Distortion temperature also. Similar reinforced improvements are obtained in glass fibre compounds also.

In India, **Pluss Polymers** manufacture Maleic Anhydride (MAH) grafted PP under OPTIM[®] brand name. These are available in various grades having different melt flow indices and MAH graft levels. Low MFI version is useful for applications like filled PP sheets and films and high mfi is particularly suitable for improving strength and flow in highly filled PP compounds for injection moulding of large parts like appliance housings and automobile parts. The high MFI version also acts as a flow aid that reduces die plate out in filled PP extrusions. By lubricating the metal / polymer interface it improves flow (higher productivity) and reduces melt imperfections. In addition, the MAH part of the molecule acts as a coupling agent, so that the filler is held better in the matrix. Coupling leads to a higher impact strength as well.

Use of such coupling agents increases the compound cost only marginally but gives substantially improved material performance. In some cases the compound cost can be effectively reduced by being able to incorporate higher quantity of filler while maintaining the same level of performance. Part of this improvement is accomplished by using equipments capable of giving better dispersion in the compound such as twin screw extruders.

Applications

Calcium Carbonate or Talc Filled PP is increasingly being used for functional mouldings like furniture and appliance housings. Availability of speciality additives and improved equipment and technology affords better dispersion of filler into the matrix polymer. This in turn makes it possible to incorporate higher filler level which results in corresponding increase in values of mechanical and thermal properties. Compounds with upto 60-80% filler content are possible to make. These are then suitably diluted with the base polymer at the time of moulding so as to get the desired filler loading in the final product, which could be of the order of 20-30%.

Materials with upto 40% filler level find use in automotive parts such as air conditioner and heater housing, exterior light housing, interior side panels, air filter housings. They are also used for appliance bodies, moulded furniture and electronic components. Sheets are also extruded out of mineral filled PP compounds. Filler content upto 80% is reported to be used in sheets for thermoformed containers.

V-Bars for Cooling Towers

15% Talc filled PP could be made die punchable only when 3% OPTIM[®] grafted PP was added at compounding stage. The extruded, punched V-bars are used for cooling towers. Other properties of the compound are :

Tensile Strength	: 450 Kg / cm ²
Modulus of Elasticity	: 29500 Kg / cm ²
Flexural Strength	: 850 Kg / cm ²
Heat Distortion Temperature	: 75°C.

Glass Reinforced PP properties obtained with addition of 1-2% OPTIM[®] grafted PP as coupling agent in 20% GF-PP are :

Tensile strength kg/cm ²	: 900
Flexural Modulus	: 40,500
Izod Impact Strength J/m	: 102

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