MODIFIERS FOR RECYCLED PLASTICS

The demand for recycled plastic compounds is rising. However, weathering, aging, degradation from multiple processing histories and contamination can cause quality and performance issues with recycled materials. Adding impact modifiers will help to boost the impact and toughness properties of recycled compounds. Adding compatibilizers will help to 'tie-together' dissimilar or incompatible polymers / contamination and boost the mechanical properties of the final compound. In addition, compatibilizers can allow you to utilize lower cost feed-stocks that are based on mixed-polymers.

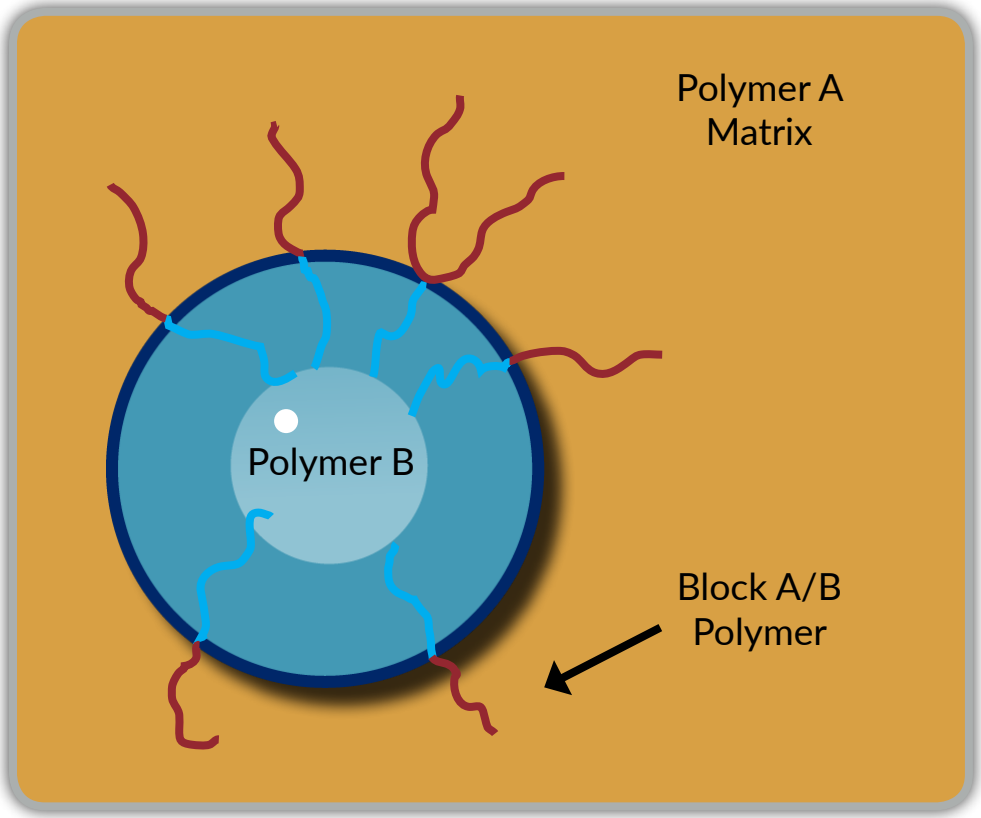
Impact modifiers are typically based on rubbers or elastomers that are added to a recycled material to improve impact, toughness, elongation and flexibility. There are a number of different types of impact modifiers and which one to use will be dependent on the polymer type that is being modified, the desired end performance, cost or other factors. Loading levels from a few percent to 30% are common depending on the desired end properties. Typical impact modifiers for various polymers are shown in Table 1 below.

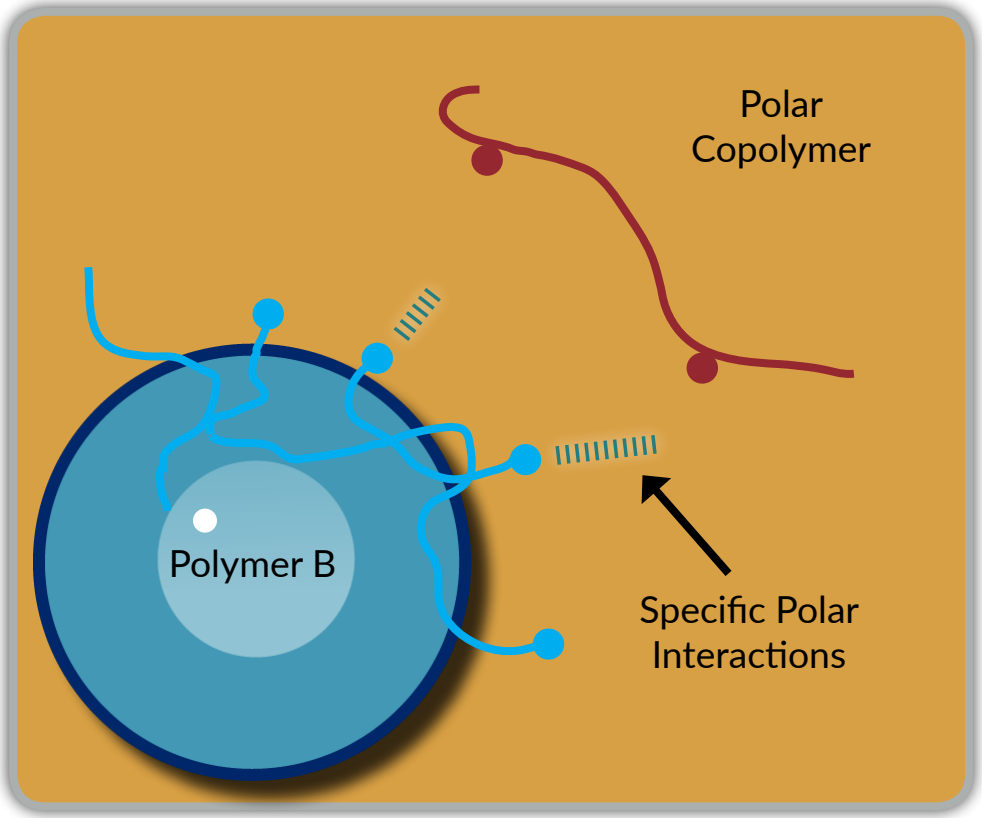
TABLE 1: Impact Modifiers for use in Various Polymers

IMPACT MODIFIER	PE	PP	NYLON	PBT POLYESTER	PET POLYESTER	PC	ABS
Polyolefin Elastomer	♻	♻					
Olefin Block Copolymer	♻	♻					
Polypropylene Based Elastomer		♻					
MAH-Grafted Polyolefins			♻	♻	♻	♻	
Acrylate Copolymers	♻	♻	♻	♻	♻	♻	♻
Ethylene-Carbon Monoxide Terpolymers							♻
Glycidyl Methacrylate Terpolymers				♻	♻		
Reactor TPOs	♻	♻					
Styrenic Block Copolymers							♻

Compatibilizers are, by definition, a substance that is added to an immiscible blend that will increase its stability. In practical terms, a compatibilizer is a modifier that is added to a blend of materials, often a polar and non-polar thermoplastic, to 'tie them together' so that they will have improved properties. Compatibilizers are often block or grafted thermoplastics so that one part of the compatibilizer interacts with one component in the blend, while the other part of the compatibilizer interacts with the other part of the blend. Examples of block and graft compatibilizers are shown in Figure 1 below.

FIGURE 1: Block and Graft Compatibilizers





Compatibilizers are also used when creating thermoplastic blends such as polycarbonate / ABS blends or nylon / polypropylene blends or for improving the dispersion of fillers like calcium carbonate. Table 2 shows the different types of compatibilizers that are used to compatibilize mixed or contaminated feed stock for recycled resins or for producing thermoplastic blends.

TABLE 2: Compatibilizers for use in Various Recycled Thermoplastic Blends

COMPATIBILIZER	PE / PP BLENDS	NON-POLAR / POLAR BLENDS	NON-POLAR / POLAR METAL	NON-POLAR / INORGANIC FILLER BLENDS	NON-POLAR / STYRENIC BLENDS
Polyolefin Elastomer	♻			♻	
Olefin Block Copolymer	♻			♻	
Polypropylene Based Elastomer	♻				
MAH-Grafted Polyolefins		♻	♻	♻	
Acrylate Copolymers	♻				♻
Ethylene-Carbon Monoxide Terpolymers			♻	♻	
Glycidyl Methacrylate Terpolymers		♻	♻		♻
Reactor TPOs	♻				
Styrenic Block Copolymers					♻