

Polyolefin Technology and Adhesive Innovation

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Today, polyolefins represent the majority of plastics produced every year and show no slowing of their high growth curve. In fact, more and more of the materials that we use every day are made from polyolefins. However, polyolefins are not a new material; industrial polyethylene production began in the 1930s. Since that time, the number of materials has grown exponentially. This high demand results in a healthy new development pipeline and a variety of materials which find use across almost every sector of our economy. These newer materials allow a breadth and robustness in adhesive applications that had previously been unavailable with polyolefin technology.

History of Polyolefins in Hot Melt Adhesives

One of the first polyolefins used in hot melt adhesives was called Amorphous Polypropylene or APP. It was a byproduct extracted during the manufacture of crystalline polypropylene and was sometimes dumped as it was considered to have little commercial value. Adhesive formulators found it to be an attractive option to use in a variety of less demanding hot melt adhesive applications. They were used in applications such as multi-wall bag laminating and in some of the first diaper construction adhesives. They could also be used in applications requiring a process aid to hold a part in place before a permanent mechanical or adhesive bond could be produced.

Once the demand and use of these materials grew to an interesting size and outpaced the byproduct supply, manufacturers began to make on-purpose grades of propylene based homo- and copolymers. This was due to advances in catalyst technology (such as Ziegler-Natta) and resulted in the proliferation of available grades. The use of these polymers in adhesives continued to grow into additional non-structural assembly applications such as cap lining, filters, etc. Within the hygiene adhesive market, they found use in applications that were extruded (slot or bead application) and had low stress requirements in the end-use. During this time, polyethylene was used primarily for applications such as case and carton sealing. None of the olefin polymers available worked in hot melt spray equipment which was starting to become popular during this time.

By the 1990s, metallocene catalyzed polyolefins became available on an industrial level. These catalysts allow a narrower molecular weight distribution and greater uniformity and control of the polyolefin structure. In adhesives, these polymers allow improved processability, flexibility, and temperature range of the adhesive compared to APP. Drawbacks such as softening, flow, and creep of the adhesives during their use could be better managed with tailored morphology. Higher temperature resistance and improved flexibility brought use in applications such as rigid packaging, automotive headliners, and in some additional low stress hygiene applications. Where substrates have moved to low surface energy films, the synergies in processability and performance are even greater.

Polymers continue to evolve with the availability of advanced metallocene catalyst materials, additional tailoring of morphology, and newer processing capabilities/technology. These evolutions

helped make the properties of the polymers more suitable to the spray equipment used in many hygiene applications. Increasingly, these polymer innovations are also focused toward the needs of the adhesive formulator with higher melt index, improved elasticity, and improved temperature resistance. The pace of development is expected to increase.

The Cracking Slate

In the 2000s, demand has put a significant strain on crude oil and the materials produced from it. We've all seen this in the price of the gas we put in our cars. The high demand also puts constraints on many items that are produced from crude oil. There has recently been a trend towards expanding the use of natural gas due to its increasing availability. Lower molecular weight carbon molecules, such as ethylene and propylene are produced from cracking either light (natural gas) or heavy (oil) feedstreams. However, many of the higher carbon atom monomers used in adhesives (such as in styrenic block copolymers and many tackifying resins) are only available from cracking heavier feeds. The trend towards lighter feedstreams puts additional pressure on demand of these materials and has resulted in a number of supply allocations, as well as high price volatility. This trend has led to rightful concern by users of adhesives and the desire for additional adhesive options across technologies.

New Adhesive Innovations

The polymer improvements, which allow higher performing adhesives to be developed, in conjunction with continued pressure on the supply of other adhesive materials (such as SBCs) make this an ideal time to develop creative innovative adhesive solutions with olefin polymers. Diversified solutions across all technologies provide the ability to give adhesive customers peace of mind that their adhesive needs will be successfully met without disruptions.

The latest developments in polymer technology have allowed for a new generation of olefin based adhesives with processability (especially the ability to be sprayed with various types of hot melt equipment) and bond performance that far exceeds previous generations. One such example of these innovations is Bostik's newly launched Relyance™ platform of adhesives for the hygiene market. Relyance brings just such a balance of robust processing in demanding spray applicator systems and robust bond performance. This means that Bostik's Relyance™ construction adhesives do not have the trade-offs previously seen with other olefin based adhesives when compared to styrenic block copolymer based adhesives. This gives hygiene producers additional options to consider in diversifying their supply base while, at the same time, not giving up performance on their production lines nor in their finished products.