UHMW-PE: the titan of polymers

ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE

by Birgit Karen Moecks

The first question that's top-of-mind for most plastics distributors when a purchasing decision arises is not "How much will it cost?" or "How quickly will I get my delivery?" or "I wonder if they'll give me that trip to Disney World for placing this order?" Instead, the single most important question for today's distributor is *"Of all the different products now available, which one will provide the perfect solution?"* Increasingly, ultra high molecular weight polyethylene, or UHMW-PE, is the correct answer.

No single product in the category exhibits all of the desirable characteristics that a customer looks for in a polymer.

Simply put, UHMW-PE has a "rare DNA." While every thermoplastic stands out with one or two key benefits, UHMW-PE possesses several. When compared to traditional polymers, it's the only thermoplastic that has the industry's highest resistance to abrasion and chemical erosion, while at the same time maintaining product integrity under higher impact-stress situations.

Röchling Engineered Plastics' Polystone® M (UHMW-PE) features excellent abrasion and chemical resistance properties, making it an ideal material for the packaging and conveying industry.

Additionally, UHMW-PE's self-lubricating character yields a non-stick surface comparable to PTFE. Put all of those benefits together with its low moisture absorption character and its low coefficient of friction, and you have the strongest, most durable plastic available anywhere — ready to go into service just about anywhere.

Uses of ultra high molecular weight polyethylene cover a diverse spectrum of applications including bulk material handling, food processing and beverage machinery, chemical, mining and mineral processing equipment, sport and leisure industry and transportation-related applications.

UHMW-PE is odorless, nontoxic and tasteless. Made up of unusually long chains with a molecular weight numbering between 3 and 6 million, these chains serve to transfer load more effectively to the polymer backbone by strengthening intermolecular interactions. This results in one of the strongest and most durable thermoplastics on the market.

UHMW-PE is produced in powder form, generally ranging from 100 to 200 microns in diameter. Because this is an extremely high viscosity polymer, compression molding and ram extrusion are the preferred processes used to generate the high pressures required to manufacture stock shapes or custom profiles where subsequent tailoring may be required.

While natural and reprocessed grades are still the most common, specialty and premium grades are becoming more popular as they allow the core UHMW-PE product to be modified by way of additives and/or fillers that enhance a desired property needed for a specific application.

EXAMPLES OF SPECIALTY GRADES OF UHMW-PE:

Glass-filled UHMW-PE

UHMW-PE filled with glass spheres is used in the pulp and paper industry as suction box covers. It has been proven to work exceptionally well, and at only a fraction of the cost of the ceramic covers it replaced. The increased hardness and improved coefficient of thermal expansion of the glass-filled product was also the answer to many of the flow problems experienced in the bulk material handling industry. The added abrasion resistance of the product also greatly improved the performance of liners in the handling of coal, sand, gravel, phosphate and fertilizer.

Cross-linking UHMW-PE

Cross-linking can improve the wear resistance by as much as 30 percent over unmodified grades, while reducing deformation under load. While dimensional stability is improved, a small decrease in tensile strength may be experienced. Ideal applications are those where increased wear resistance is required such as conveyor wear strips and guides, as well as bin and hopper liners.

U.V. stabilized

The properties of unmodified UHMW-PE can begin to decrease in less than one year when exposed to extreme, direct sunlight. But resistance to light can be increased up to five times with the correct additives. Although typically achieved with carbon, other stabilizers can be used if the end product is not black in color. U.V. stabilized UHMW-PE excels in virtually any application where the material is exposed to direct sunlight such as chute, hopper and truck-bed liners.

Anti-static

Standard grades of UHMW-PE are non-conductive and will allow static charges to build up on the surface. Additives can

improve the surface resistance to a range of 10^6 to 10^{11} ohms/square. The conductivity dissipates the static build up when used on conveyor parts and also helps protect more static sensitive products such as circuit boards. You will find UHMW-PE used extensively in manufacturing processes of electrical components. These same additives can help the surface resist dust, making the product perfect for applications as diverse as grain handling and ammunition plants.

MoS_2 filled

Molybdenum disulfide is growing in popularity as an additive since it further reduces the product's already low coefficient of friction. As a dry lubricant it performs extremely well without attracting dust and dirt. Applications include various conveyor components such as curve tracks and guide rails, as well as nonstick liners and wear plates.

Oil-filled

Food processing and packaging equipment manufacturers commonly use UHMW-PE chain guides, sprockets and curve tracks. When oil-filled UHMW-PE is used in place of standard grades, the parts perform with an even lower coefficient of friction allowing chains and tracks to move easier and quieter, and the product conforms to all FDA and USDA guidelines. This product is not recommended for dusty environments.

Flame retardant

Flame retardant levels that are sufficient to meet MSHA requirements for underground mining can be achieved with the proper additives. The additives tend to slightly reduce the impact and wear resistance, but this product remains one of the best wear-resistant, flame-retardant polymers available. Typical applications are wear pads and chain guides in the mining industry.

Heat stabilized

The continuous operating temperature of unmodified UHMW-PE is generally rated at 180°F (82°C). However, specific additives allow the material to be used in environments up to 300°F (148°C) while maintaining its inherent abrasion, impact and corrosion-resistant properties. Applications of heat-stabilized UHMW-PE include conveyor components that are exposed to higher temperatures, such as food processing and baking equipment.

These specialty grades offer just a few examples of one of UHMW-PE's other inherent characteristics: adaptability. UHMW-PE is the most versatile of all thermoplastics. Unlike any other thermoplastic, it provides sheet, rod, tube and profile manufacturers unlimited opportunity to shape new profiles for custom applications. So, for the benefit of your customers, remember, with UHMW-PE almost anything is possible.

To improve the value of your relationship with your customer, as well as your profits, contact your manufacturer today to learn more about UHMW-PE, the "Titan of Polymers." ■

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