

UHMW-PE: the “ultra” material

ULTRA HIGH
MOLECULAR
WEIGHT
POLYETHYLENE

by Rohit Saigal and Deborah Wright

Ultra high molecular weight polyethylene, or UHMW-PE as it is most commonly referred to, is the most versatile polyethylene for industrial needs on the market today. This low-cost material outperforms many of the other plastics materials being offered.

UHMW-PE is used in a wide variety of applications, ranging from something as sensitive as joint replacements in humans to a product as crucial as radiation shielding in nuclear submarines. Dewatering elements on paper-making machines and chute liners are also commonly used applications of UHMW-PE and show the versatility of the product's application.

UHMW-PE is a very light-weight material that can be easily handled and has practically zero water absorption. Because of its light-weight nature, installation is trouble-free. The ease with which UHMW-PE is machined makes it a perfect material to mill, plane, saw, drill and rout into a variety of fabricated parts.

UHMW-PE is a high viscosity polymer, and because of its extremely low melt-flow index and very high molecular weight, it cannot be processed by the common methods used in ordinary thermoplastics. Compression molding (or press sintering) and ram extrusion processes are used to generate the high pressures needed to produce this material into various shapes and sizes.



Polyslick UHMW™ sheet can be manufactured using additives to enhance the physical properties.

UHMW-PE is commonly manufactured in sheet, rod, tube and profile. Ultra high molecular weight polyethylene has a molecular weight ranging from 3 to 6 million g/mol. This extremely high molecular weight gives UHMW-PE the unique properties of high abrasion resistance and high impact strength. These characteristics when combined with its intrinsic properties of low coefficient of friction and chemical resistivity, enables UHMW-PE to have many widespread applications.

Characteristics of UHMW-PE

• **High abrasion resistance** — UHMW-PE exhibits excellent resistance to abrasion and wear. In many industrial applications it has shown itself to be the ideal choice where it will be subjected to sliding contact with abrasive materials. Its high abrasion resistance gives it the ability to essentially wear itself instead of other more expensive materials. For this reason, UHMW-PE is the ideal material selection where wear is the major consideration.

The abrasion resistance of UHMW-PE makes it an excellent choice as a truck bed liner material in heavy duty dump trucks. This unique property also lends itself to wear elements in high wear applications such as dewatering elements in the paper industry. Wear parts made out of this material display a substantial reduction in wear when compared with metal components, which in turn can translate to substantial cost savings.

• **High impact resistance** — UHMW-PE's extremely high molecular weight also provides it with excellent impact resistance. Its large molecules hold the material together when subjected to high impact forces and also gives the material an incredible resiliency. Its ability to absorb shock stress is very high, even at temperatures down to -140°F (-95°C). In fact, UHMW-PE has the highest impact strength of any thermoplastic material. UHMW-PE's impact resistance also makes it suitable for truck bed liners which can see large impact forces.



Polyslick UHMW™ fabricated into various shapes and sizes by Polymer Industries.

• **Chemical resistance** — UHMW-PE is highly resistant to a wide array of aggressive and corrosive chemicals, many of which cannot be used with ordinary metals. The material is resistant to strong oxidizing agents, aromatic and halogenated hydrocarbons and most acids. This resistivity to aggressive media enables UHMW-PE to be used in the bulk handling of many chemical materials. It also enables it to be used in the food and pharmaceutical industries. It is FDA and USDA approved to come in direct contact with consumables.

• **Low coefficient of friction** — UHMW-PE displays a very low coefficient of friction, which is critical where material flow is essential. Its self-lubricating, non-stick surface is a great benefit in dry-sliding movement between metal surfaces such

AVAILABLE GRADES OF UHMW-PE

- Virgin natural UHMW-PE
- Virgin colored UHMW-PE
- Reprocessed UHMW-PE
- UV stabilized UHMW-PE
- Crosslinked UHMW-PE
- Anti-static UHMW-PE
- Conductive UHMW-PE
- Glass-filled UHMW-PE
- Oil-filled UHMW-PE
- Moly-filled UHMW-PE



UHMW-PE sheet, rod and profile can be used in variety of shapes and sizes for use in many diverse applications. Pictured above are examples of UHMW-PE used in various industries, provided by Polymer Industries India Ltd.

as steel, brass and copper. UHMW-PE's lower coefficient of friction ensures that it outperforms steel in applications where flow is critical. Its inherent lubricity minimizes the heat-generating friction which gradually destroys steel parts and ensures smooth noiseless operations. Also, the material's tremendous release properties are invaluable as it prevents caking of all types of bulk materials on its surface, making it easier to clean.

Specialty markets served

Ultra high molecular weight polyethylene is also environmentally friendly. Be-

cause of UHMW-PE's great conversion capabilities and the fact that it can be repeatedly converted — losing only a fraction of its physical properties — it is financially feasible to “reprocess” the material. UHMW-PE also readily accepts additives which can greatly enhance its performance, making it possible to formulate “specialty materials” tailored for the specific application.

Typical applications of UHMW-PE are: dewatering elements, wear strips, chain guides, star wheels, gears, sprockets, guider rollers, truck liners and dock fenders.

UHMW-PE is definitely one of the most versatile plastics on the market today. It can outperform most thermoplastic materials as well as some engineering and specialty materials. UHMW-PE has long been recognized as the ideal low-cost material solution for challenging applications. ■

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