

The difference between LDPE, LLDPE, MDPE, XLPE, UHMW for sheeting applications

What's the difference between LDPE, LLDPE, MDPE, HDPE, XLPE and UHMW sheeting?

Polyethylene is a polyolefin. Polyolefins are high molecular weight hydrocarbons. Polyolefins include linear low density polyethylene, low density polyethylene, high density polyethylene, polypropylene copolymer, polypropylene, and polymethyl pentene. These are the only plastics that have a lower specific gravity than water. This means that they weigh less than water. These materials can become brittle from oxidation and are damaged by exposure to UV light.

When ethylene is polymerized the result is relatively straight polymer chains. From the main chain they can branch out. We get different kinds of Polyethylenes from the varying degree of branching in their molecular structure. Below are brief descriptions on how the polyethylenes differ from each other.

LDPE (Low Density Polyethylene) has the most excessive branching. This causes the low density to have a less compact molecular structure which is what makes it less dense. It has a density of 0.91-0.925g/cm³.

LLDPE (Linear Low Density Polyethylene) has a significant number of short branches. Because it has shorter and more branches its chains are able slide against each other upon elongation without becoming entangled like LDPE which has long branching chains that would get caught on each other. This gives LLDPE higher tensile strength and higher impact and puncture resistance than the LDPE. It has a density of 0.91-0.94g/cm³.

MDPE (Medium Density Polyethylene) has a little less branching than the HDPE. It is less notch sensitive than HDPE and has better stress cracking resistance. It has a density range of 0.926 - 0.94 g/cm³

HDPE (High Density Polyethylene) has minimal branching of its' polymer chains. Because it is denser it is more rigid and less permeable than the LDPE. It has a density of 0.941-0.965g/cm³.

XLPE (Crosslinked Polyethylene) is high density polyethylene which has covalent bonds between connecting its polymer chains. These bonds are caused by using heat plus chemicals or radiation and they help to form 3-dimensional polymers with high molecular weights. These bonds tie the polymers together and lengthening the polymer chains giving it better physical properties. The molecular structure that is formed by crosslinking provides superior stress cracking, improved toughness, stiffness, and chemical resistance compared to the HDPE.

UHMW (Ultra High Molecular Weight Polyethylene) has extremely long chains, with molecular weight numbering in the millions (usually between 2 to 6 million). In general, HDPE molecules have between 700 and 1,800 monomer units per molecule, whereas UHMW molecules tend to have 100,000 to 250,000 monomers each. The chains of UHMW align in the same direction. The bonds between the chains are not very strong however, because they are so long there are more bonds holding it together than polyethylene with shorter chains. These long chains give UHMW high tensile strength. The longer chains serve to transfer load more effectively to the polymer backbone by strengthening intermolecular interactions. This causes the material to be very tough and gives it the highest impact strength of the polyethylenes. It has a density of 0.928-0.941 g/cm³