A REVIEW ON HIGH DENSITY POLY ETHYLENE AS ENGINEERING POLYMER

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Abstract: *Engineering thermoplastics are a subset of plastic materials that are used in applications generally requiring higher performance in the areas of heat resistance, chemical resistance, impact, fire retardancy or mechanical strength. Engineering thermoplastics are so named as they have properties in one or more areas that exhibit higher performance than commodity materials and are suitable for applications that require engineering to design parts that perform in their intended use.*
Keywords: *high density polyethylene, engineering polymers, HDPE specifications.*

INTRODUCTION

Wood fibers do not easily disperse in non-polar polymers such as PE. It was reported, for HDPE/wood fiber composites, that the tensile strength decreases monotonically with increasing fiber content, and was attributed to the poor fiber dispersion during composite fabrication. Stearic acid used to improve the dispersion[1-3]. Malleated polyethylene (MAPE) or maleic anhydride grafted–polyethylene (PE-g-MA) has been extensively used as a compatibilizer in HDPE/wood composites[4]

Yuanwen Wu[5] reported that various composites of HDPE with maple wood flour have been prepared with the addition of the compatibilizer, maleic anhydride, and the flame-retardant agent, magnesium hydroxide. It was found that the addition of maple wood flour to the HDPE matrix facilitates its oxidation and combustion, while maleic anhydride has little effect on the thermal behaviors of composites.

Alireza Dorostkar[6] studied the effect of wood species and particle size on mechanical properties of wood plastic composites (WPC) and high density polyethylene (HDPE). Wood plastic composite (WPC) were made with 30% HDPE in a batch process at 185°C, at two particle sizes of 40 mesh and 80 mesh. Maleic anhydride polypropylene (MAPP) was used as a coupling agent. MOE, MOR, maximum tensile strength (MTS) increased with increasing particle size. He found that at wood/plastic ratio 70:30 the mechanical properties (MOE, MOR and Maximum tensile strength) increased as particle size increased[7].

APPLICATIONS

Ideal for making insulated and corrosion resistant liners in chemical, electromechanical, food and pharmaceutical industry or can be used to be machined into mechanical parts like gear, bearing, etc.

HDPE SPECIFICATIONS

Sheet			
Length (mm)	Width (mm)	Thickness (mm)	Color
2000	1000	1 - 200*	Natural / Black*
3000	1500		

Rod		
O.D (mm)	Length (mm)	Color
10 - 300*	1000	Natural / Black *

Note: *Size and color is subject to availability. Other color is available on request. some sizes are not necessarily held in stock but can be back ordered with MOQ. We offer cut to size and machining service.

HDPE PROPERTIES

Item	Unit	Value
Density	g/cm^3	0.95
Water Absorption	%	< 0.01
Working Temperature	°C	-48~ 82
Tensile Strength	Mpa	29
Elongation at Break	%	300
Impact Strength of Izod	KJ/㎡	800
Hardness	Shore A	65
Linear Expansion Coefficient	10^{-5}cm/cm°C	1.5-2.5
Thermal Deformation Temperature	°C	85
Surface Resistivity	Ω.cm	10^{17}
Dielectric Strength	KV/mm	75

Traditional reinforcements and internal AF lubricants are:

- PTFE
- Silicone oil
- Graphite
- MoS2
- Aramid
- Carbon fibre
- Glass fibre
- Alloy- / blend technology e.g. HWPE

Effects of reinforcements and internal AF lubricants are:

- PTFE reduces the coefficient of friction. Is effective at high pressure. Creates a PTFE film between the compound and the counterface.
- Silicone oil reduces coefficients of friction. Migrates to the wear surface. Offers lubricity at start up and at high speeds. Not effective at high surface pressures.
- PTFE with silicone oil improves tribological properties over a broad velocity range. Excellent for oscillatory motion (less "slip stick"). Considerable improvement in LPV at high speeds.

- Molybdenum Sulphide ($MoS2$) enhance the crystallization of PA (surface hardening). Reduction of "slip stick" effect. Moderate improvement of wear factor.
- Graphite Powder as boundary lubricant often used in aqueous moisture environment.
- Aramide for improvement of the wear factor. Low counter face wear against soft metal, e.g. Cu, Al. Low plastic-on-plastic wear (identical partner). Low noise. Low abrasive wear. Dimensional stability.
- Carbon fibres improve mechanical performance. Results in higher LPV-value and in reduction of wear factor. Reduce wear of both surface and mating surface as compared to glass fibres. Statically dissipate / conductive.
- Glass fibres improve mechanical properties. Higher LPV-value. Reduction of wear factor. Increase wear of mating surface.

CONCLUSION

HDPE is a thermoplastic polymer produced from the monomer ethylene. HDPE is used in the production of plastic bottles, corrosion-resistant piping, and plastic wood. The blending of polymers is an economically attractive route to develop new materials that combine the desirable properties of more than one polymer and obtaining materials with improved property/cost performances. HDPE exhibit greater durability, require less maintenance, absorb less moisture, and provide superior fungal resistance When exposed to moisture, it does not absorb water it is considered a superior fungal resistance and dimensional stability compared to steel.

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NOTES ON THE AUTHORS

Abdallah El-gharbawy is Research and development engineer for three years, process engineer for two years. Eventually, my current profession is a project engineer for three years and it is lasting. **For my graduates and postgraduate degrees**, I have a BSc in petroleum refining and petrochemical engineering. In addition, I have an MSc in chemical engineering. I have Ph.D. in material science.