



Optiplate TM

Wear Technologies

What is OptiplateTM

Optiplate is a new kind of engineering thermoplastics with more than 3 million viscosity-average molecular weight. Ultra-high molecular weight polyethylene plate has superior performance over conventional polymer wear products such as very high wear resistance, impact resistance, excellent resistance to internal pressure strength, resistance to environmental stress cracking, intrinsically self-lubricating, anti-adhesion, low temperature resistance and excellent chemical resistance.

Performance Properties

Optiplate is ideal for lining inside chutes in all industries that are subjected to continuous high-volume material as found in the mining industries. Typically, in transfer chutes ore carts reclaimer bucket inserts replacement of typical metal hard skirts and conveyor belt scrapers.

Optiplate is 1/8 the weight of mild steel but is high in tensile strength.

Also, unlike steel, Optiplate is an inexpensive alternative to metals and ceramics, and because it is self-lubricating, long-wearing, and resistant to abrasion, and corrosion.

Optiplate is well suited for wear applications that demand high abrasion resistance combined with low friction.

Advantages of Optiplate Over Steel plate

- 40 times the abrasion resistance of steel (ref. Madsen)
- 8 times lighter than steel
- 5 times lower coefficient of friction than steel
- Less material hang-ups in Chutes due to less abrasive properties

Optiplate offer high wear and abrasion resistance, making it ideal for Wet Fines mining application in wet plants. The low friction of Optiplate enables solid particles to slide easily over the surface and avoids scaling and fouling.

The smooth surface of Optiplate assures low friction loss and high flow rate.

About Optiplate™ Plate

- Ultra-wear resistant
- Ultra-low friction
- Ultra-smooth
- Ultra-tough
- Ultra-high molecular weight

Uses of Optiplate™ Plate

- Transfer Chutes
- Chute lining
- Conveyor Belt Scrapers
- Surge Bins
- Soft /Hard Skirts
- Bulk waste chutes

When abrasive material comes in contact steel the effect on the surface can be very damaging. Abrasive wear within these transportation systems occurs when hard particles are forced against the surface of the plate. A loss of material thickness is the result of the hard, sharp, angular edges producing a cutting or shearing action on plate surface. In more extreme cases, these effects can result in blow outs or failure, or significant maintenance costs and downtime for wear plate replacement. Steel plate is simply not abrasion resistant enough to stand up to the abuse.

Most abrasion-resistant plate options operate on the premise that when two objects meet, the harder object 'wins'. To deal with this phenomenon, products are available in a variety of hardness, measured on the Brinell Scale, from A-R steel (200 BHN) through iron cast plate (up to 800 BHN). Unfortunately, any product that is very hard throughout thickness is also extremely brittle.

However, one type of plate can offer the best of both worlds: recently developed Optiplate plate exhibits extremely high abrasion resistance combined with good ductility and flexibility. The plate can be cut and bent to almost any shape and size as per the requirements of the client.

Slurry Wear Resistance

TABLE 1 – Flow-through slurry wear rates for several materials. Test conditions: 2 weight % silica sand (50/70 mesh) in tap water, impeller velocity 15.7 m/s, temperature range 6 to 17 degrees C

<u>Material</u>	<u>Wear Rate mm³/h</u>	<u>Hardness HV</u>	<u>Carbon Weight %</u>
1020 steel	23.0	130	0.18
304 stainless steel	22.3	157	0.06
A514 Steel	21.1	284	0.19
316 stainless steel	18.5	151	0.04
5145 steel	15.6	298	0.61
1080 steel	15.2	172	0.78
8740 steel (heat treated)	14.3	585	0.42
4142 steel (heat treated)	10.2	580	0.30
Cobalt-base facing No.1	8.91	438	1.33
4243 steel (heat treated)	7.08	690	0.42
1060 steel (heat treated)	6.11	695	0.59
1080 steel (heat treated)	5.27	789	0.78
Nickel-base hard facing	3.61	585	0.56
Cobalt-base facing No.2	2.43	518	1.15
White cast iron (17Cr)	2.17	655	3.00
Cobalt-base facing No.3	1.37	513	1.18
Optiplate	0.537	N/A	N/A

MADSEN AND BLICKENSBERGER ON FLOW-THROUGH TEST 177

Table 1: presents the normalised wear rates for 17 materials. The materials represented include steel alloys, hard facings, and Optiplate™. The test conditions, hardness and carbon content are included in the table. The data show a wide range of wear rates among the various materials. Differing by a factor of 43. Among the materials, Type 1020 steel had the highest wear rate, the Optiplate™ had the lowest wear rate, only 2.5% of that of the standard type, A514 steel. For the metallic specimens these illustrated the importance of hardness and carbon content for high wear resistance.

Wear Resistance Table

Material	Relative loss from Abrasion	Resistance as a % of Steel
Optiplate ®	22	454
AR Steel	62	161
304 Stainless	82	122
Carbon Steel	100	100
HDPE	218	-218
PVC	532	-532
6061 Aluminium	1042	-1042

Taber Abrasion Resistance

Taber Abrasion Comparison (CS17 wheels, 1000g load, 5000 cycles)
Taber Abrasion (mg loss/1000 cycles)

<i>Optiplate</i> [®]	39
PTFE	45
Nitrile rubber	48
Nylon	50
PEEK	55
Acetal	137
ABS	275
Neoprene rubber	278

Low Coefficient of Friction

Optiplate has a very low coefficient of friction and is self-lubricating. Its coefficient of friction is significantly lower than that of nylon and polyacetal and is comparable to that of PTFE (Teflon), but Optipipe has better abrasion resistance than PTFE (Teflon).

Coefficient of Friction

- Teflon pipe (Static) = 0.04
- Optipipe pipe (Dynamic) = 0.14
- Optipipe pipe (Static) = 0.16
- HDPE pipe (Static) = 0.25
- Steel pipe (Static) = 0.8

Smooth Surface

Optiplate plate has a smooth surface which assure low friction loss and high flow rate. Because Optiplate plate does not rust, pit, scale, or corrode, the high flow rate continues for the life of the wear system.

Roughness *Optiplate™* plate has a surface rough (k) value of 0.0010 (compared to other materials below)

Surface	Absolute Roughness - k	
	$10^{-3} (m)$	(feet)
Copper, Lead, Brass, Aluminum (new)	0.001 - 0.002	$3.3 - 6.7 \cdot 10^{-6}$
PVC and Plastic Pipes	0.0015 - 0.007	$0.5 - 2.33 \cdot 10^{-5}$
Epoxy, Vinyl Ester and Isophthalic pipe	0.005	$1.7 \cdot 10^{-5}$
Stainless steel	0.015	$5 \cdot 10^{-5}$
Steel commercial pipe	0.045 - 0.09	$1.5 - 3 \cdot 10^{-4}$
Stretched steel	0.015	$5 \cdot 10^{-5}$
Weld steel	0.045	$1.5 \cdot 10^{-4}$
Galvanized steel	0.15	$5 \cdot 10^{-4}$
Rusted steel (corrosion)	0.15 - 4	$5 - 133 \cdot 10^{-4}$
New cast iron	0.25 - 0.8	$8 - 27 \cdot 10^{-4}$
Worn cast iron	0.8 - 1.5	$2.7 - 5 \cdot 10^{-3}$
Rusty cast iron	1.5 - 2.5	$5 - 8.3 \cdot 10^{-3}$

Lightweight



Optiplate plate is lightweight – approximately one-half the weight of aluminium and one-eighth the weight of steel – reducing transportation, handling, and installation costs and can be manufactured to custom application designs and colours.

Key Benefits of Optiplate™ Plate

Impact resistance: Optiplate plates have strong enduring capability to the impacts from various sands, fines, mud and slurries.

Corrosive resistance: With higher structure stability, Optipipe pipes are corrosive resistant to sea waters. No electro chemical corrosion, no need anti-corrosive coating.

Light weight: The density of Optiplate is only 1/8 of steel plate. It is easy to move and install, especially suitable for the working sites where lifting machines is not available.

Lower Downtime

Optiplate plate offers: Lower Maintenance Costs, Less Maintenance Downtime.

The superior wear resistance of Optiplate significantly increases the time between plate replacements and/or rotations leading to large savings by way of reduced maintenance costs and lost production. It therefore lends itself to high wear areas and where redundancy is poor/low.

The low mass allows for ease in hand ability and reduced structural support requirements. Corrosion resistance, whether oxidative or chemical, allows for asset life extension across the life of mine in low wear applications. In gravitational launders the low friction coefficient reduces the need for large angles and excessive wash water addition for throughput.

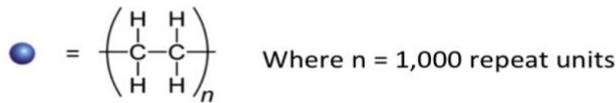
Role of Optiplate

Optiplate is a polyethylene polymer with an average molecular weight is greater than 3,100,000 as defined by ASTM D4020 – Standard specification for Optiplate polymers. This molecular weight is well above the molecular weight of most typical polymers which are between 1,000,000 and 400,000 thus earning the title of a type of Optiplate. Optiplate's molecular weight is in the 3.1-4.5 Million range have been found to exhibit the best combination of impact strength and abrasion resistance. For Polyethylene molecular weight classification, the following guidelines can be used:

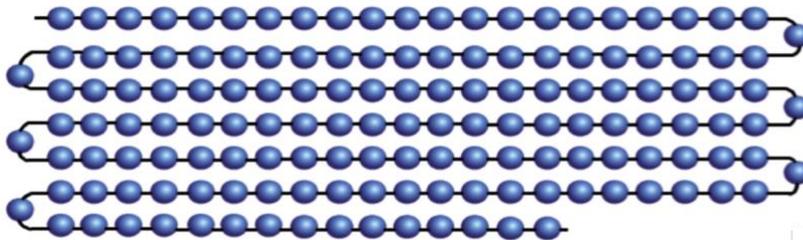
- HDPE (High Density Polyethylene): 100,000 – 400,000 MW
- HMWHDPE (High Molecular Weight High Density Polyethylene) 500,000 – 1,999,999

- VHMWHDPE (Very High Molecular Weight High Density Polyethylene) 2,000,000 – 3,100,000
- **Optiplate™** > 3,100,000 + MW

Molecular Weight



Conventional HDPE



Optiplate™

Attributes of Optiplate™ Plates

- Abrasion resistance – Optiplate have excellent abrasion resistance providing long life in abrasive slurry applications.
- Chemical resistance – outstanding resistance to a wide range of chemical reagents allows the use of Optiplate systems in tailings, production and chemical treatment applications used in mining operations.
- Flexibility – Optiplate plate offers flexibility and resiliency allows the plate to absorb vibration and stresses caused by product movement.
- High flow capacity – low friction compared with materials such as fibre reinforced cement and resistance to material deposit build-up give Optiplate plate long lived high resistance capacity.
- Ease of installation – Optiplate is easy to install with **Optiplate™** installation system and is light weight reducing injury exposure to the work force.
- Reduce costs in installation from conventional wear material.

Benefits of Optiplate™

Optiplate by virtue of its extremely high molecular weight yields several unique properties, including the highest abrasion resistance and highest impact strength of any plastic.

Beware of competitive products claiming to be Optiplate as some techniques for processability of Optiplate is not without an attendant disadvantage since effective amounts of intermediate molecular weight polyethylene causes a marked decrease in some of the most desirable properties of the Optiplate, such as impact strength and abrasion resistance.

The high molecular weight is what gives Optiplate a unique combination of high impact strength, low coefficient of friction and abrasion resistance that outwears carbon steel 10 to 1 making it more suitable for many applications where lower molecular weight grades fail.

Optiplate can be used in a broad range of mining and industrial slurry applications due to its three main characteristics: high impact strength, outstanding abrasion resistance and extremely low coefficient of friction.

Exceptionally High Wear

Optiplate shows unusually high wear resistance compared to most materials. This is due to a combination of very high molecular weight and the resulting entanglements and relative surface softness with a slippery waxy surface.

Bowl of Spaghetti

An easy way to envisage Optiplate is to think of a plate of cooked spaghetti with the long strands all intertwined. If the spaghetti is cut up, it would closely approximate the molecular appearance of regular HDPE. Since very long strands of spaghetti approximating the chains of Optiplate is completely intertwined it would be very difficult to pull them apart. This simplification explains the outstanding abrasion resistance (the difficulty in pulling out particles of the polymer).

Uses

- Mining Industry - Optiplate is used as in chutes for process and ore movement.
- Waste Transfer Plants – Utilised in chutes and bins

Wear Resistance

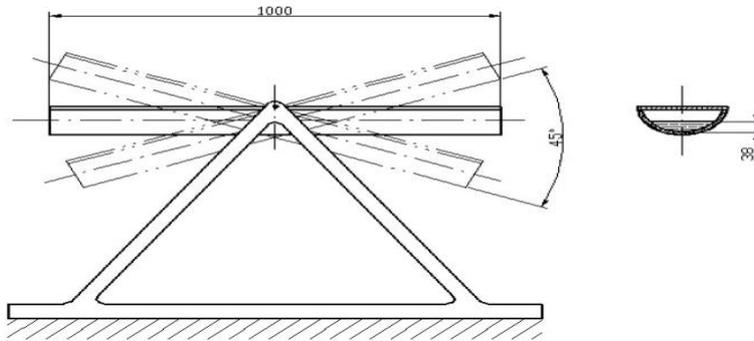


Fig. 1. Schematic diagram of wear resistance testing apparatus according to TH Darmstadt requirements

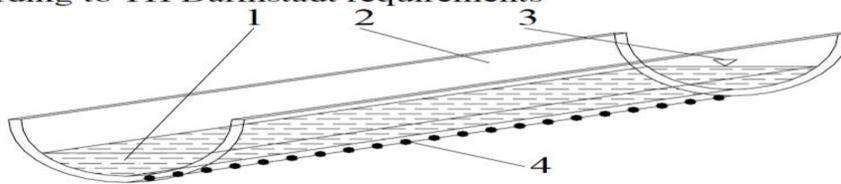


Fig. 2. Test sample: 1 – water with abradant, 2 - test sample, 3 - water level, 4 - wall thickness measuring points

Abrasion Resistance

Of all the materials, Optiplat exhibit the smallest abrasion index. Of all the plastic pipes presently available, the anti-abrasion performance of Optiplat is 18 times higher than phenolic polymers, 6 times higher than polyamide polymers (PA66), 5 times higher than poly(tetrafluoroethylene) (PTFE) as well as being 6.6 times higher than carbon steel, 5.5 times higher than stainless steel and 27 times higher than copper, so Optiplat™ plate can profoundly increase the service lifespan of wear plate.

Optiplate™ *Properties Comparisons*

Immunity to Galvanic or Electrolytic Attack

Optiplate plate is immune to galvanic or electrolytic action. They can be used underground, underwater, in the presence of metals, and can be connected to metals.

Thermal Properties

Optiplate plate have lower thermal expansion properties than conventional HDPE.

Chemical Resistance

- Chemical and Corrosion Resistance
- With chemical resistance second only to PTFE (Teflon), Optiplate offers superior life to other plating products in chemically aggressive or corrosive applications under most operating conditions
- Optiplate plate can withstand 80% hydrochloric acid.
- Optiplate is highly resistant to corrosive chemicals, with exception of oxidizing acids.
- Optipipe pipes are inert to attack by a wide variety of strong acids, alkalis, salt solutions, alcohols, and many other chemicals. They are dependable in corrosive applications and impart no tastes or odours to materials carried in them.

Optiplate™

Chemical Specification Table

Optiplate™ Chemical resistance of dumbbell-type test specimens after 30 days

+, resistant (mechanical properties not appreciably affected); —, not resistant (decrease in yield stress and ultimate tensile strength greater than 20%); X, limited resistance decrease in yield stress and ultimate tensile strength less than 20%

Reagent	Temperature			Reagent	Temperature		
	20 °C (68 °F)	50 °C (120 °F)	80 °C (175 °F)		20 °C (68 °F)	50 °C (120 °F)	80 °C (175 °F)
Inorganic acids				Hydrocarbons and halogenated hydrocarbons			
Chromic acid (80%)	+	+	X	Benzene	X	X	
Hydrochloric acid (concentrated)	+	+	+	Carbon tetrachloride	X		
Hydrocyanic acid	+	+		Cyclohexane	+	+	
Hydrofluoric acid	+	+		Dichloroethylene	—	—	
Nitric acid (concentrated)	—	—	—	Diesel oil	+	+	X
Nitric acid (50%)	X	—	—	n-heptane	+	+	
Nitric acid (20%)	+	+	X	Petroleum ether	+		
Phosphoric acid (85%)	+	+	+	Trichloroethylene	X	—	
Sulfuric acid (concentrated)	+	—	—	Toluene	X	—	
Sulfuric acid (75%)	+	X	X	White spirit	+	X	
Sulfuric acid (50%)	+	+	+	Xylene	X	X	—
Alkalies				Alcohols, ketones, ester and amines			
Aqueous ammonia	+	+		Acetone	+	+	
Potassium hydroxide solution	+	+		Aniline	+	+	X
Sodium hydroxide solution	+	+	+	Benzyl alcohol	+	+	+
Aqueous solutions of inorganicsalts				Butyl alcohol	+	+	+
Aluminum chloride	+	+	+	Cyclohexanol	+	+	+
Ammonium nitrate	+	+	+	Ethanol	+	+	
Bleaching powder	+	+	+	Ethyl acetate	+	+	
Calcium chloride	+	+	+	Ethylene glycol	+	+	+
Sodium carbonate	+	+	+	Glycerine	+	+	+
Sodium chloride	+	+	+	Lauryl alcohol	+	+	+
Sodium hypochlorite	+	+	+	Propyl alcohol	+	+	+
Zinc chloride	+	+	+	Miscellaneous			
Organic acids				Beer/Wine	+	+	+
Acetic acid (99%)	+	+	X	Detergents in aqueous solution	+	+	+
Acetic acid (10%)	+	+	+	Distilled water	+	+	+
Butyric acid	+	+		Hydrogen peroxide 30% (perhydrol)	+	+	
Citric acid	+	+	+	Linseed oil/olive oil	+	+	+
Formic acid	+	+		Milk	+	+	+
Oleic acid	+	+	X	Seawater	+	+	+

Other Capabilities

Please enquire for customised applications we also manufacture products like Optipipe

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