

Densit Wear protection

Densit® WearFlex
Densit® WearCast
Densit® WearSpray

- for a range of processing industries



In processing industries, unexpected or unscheduled plant shutdowns, caused by wear in processing machinery, are costly and thus reduce competitiveness. Wear is especially familiar in those industries that process or use large quantities of abrasive material in their production plant.

The processing industries' demands for efficiency and economy, by reducing maintenance costs and shutdown time, are an important source of inspiration.

” *Within the framework of the Densit® technology, we fulfil the needs of specific market segments for materials and systems to reinforce areas which are both exposed to severe demands and are critical to the end users' activities.* ”

With its unique technology, ITW Engineered Polymers has developed products especially designed for the wear protection of processing parts in industrial plants. Over the years ITW Engineered Polymers has accumulated detailed knowledge and experience of solving such problems.

Product overview

- MATERIALS

WEARSPRAY WEARCAST WEARFLEX

DENSIT® WEARFLEX

Densit® WearFlex is a range of extremely high-strength compounds combined with hard-wearing aggregates. Densit® WearFlex is available as both low- and high-temperature products, catering for process temperatures up to 400 °C (750 °F) and 1200 °C (2190 °F) respectively. All low temperature WearFlex products have now been improved to a degree making fibres superfluous when trowel on standard expanded metal mesh. Densit® WearFlex products can be troweled directly onto an anchoring mesh in typically a thickness of 20-50 mm (3/4"-2").

DENSIT® WEARCAST

Densit® WearCast is a range of extremely high-strength compounds combined with hard-wearing aggregates. Densit® WearCast is available as both low- and high-temperature products, catering for process temperatures up to 400 °C (750 °F) and 1200 °C (2190 °F) respectively. Densit® WearCast products can be cast in a wide range of shapes.

DENSIT® WEARSpray

Densit® WearSpray consists of an extremely high-strength compound combined with hard-wearing aggregates. The maximum permissible process temperature is 400 °C (750 °F). Densit® WearSpray is installed by spraying onto an anchoring mesh, giving flexibility and speed in installation.



- CONCEPTS

DENSULATE COMPONENTS

DENSIT® COMPONENTS

The linings are completely jointless and can be formed into any geometry.

The flexibility and smoothness means that the lining can be formed into the ideal shape, graduating seamlessly in thickness to meet the need for greater or less wear protection in different areas within a component.

DENSIT® INSULATED WEAR PROTECTION

Densulate insulated wear-resistant linings are designed to protect components against erosive wear, while at the same time reducing heat loss by radiation. They consist of Densit® wear protection lining installed over an underlying insulation layer.



- wear protection systems

The Densit® range of wear protection systems comprises:

- ✓ Densit® wear protection products.
- ✓ Densit® components.
- ✓ Densit® insulated wear protection.
- ✓ Auxiliary products.

Densit® wear protection products

All Densit® solutions offer unique properties in wear protection:

- ✓ High wear resistance.
- ✓ No vulnerable joints.
- ✓ Seamless graduation in lining thicknesses, including eccentric lining in pipes.
- ✓ Flexibility in installation for complex geometries.
- ✓ Fast and easy installation including overhead applications.
- ✓ Mechanical reinforcement ensuring that linings do not become dislodged.
- ✓ High thermal resistance and absorption.

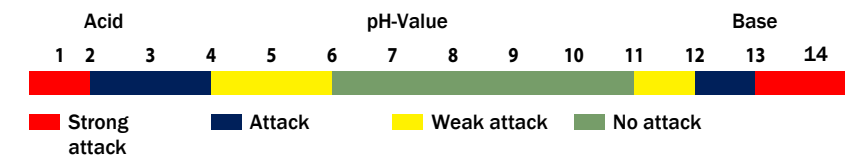
Technical Guidelines

The lifetime of Densit® wear protection increases with reduction in particle size, slower particle velocity, and a smaller angle of particle impact.

Densit® products are safely recommended for wear protection in environment where:

- Impacting particle size is up to 4 mm in diameter

- Impacting particle velocity is up to 25 m/s
- Impact angle is smaller than 45°
- When alkalis are present in the environment by more than 2 % (by weight) it will in some cases attack Densit® products
- Densit® products will show optimal performance when the environment pH-value is in the range 6-11



Based upon the physics of wear mechanisms the general thumb rule is that the wear rate can be assumed to increase with maximum particle size raised to the third power and with maximum particle velocity raised to the third power (i.e. a 25 % increase in particle size or velocity will double the wear rate). Also, the wear rate increase with hardness and angularity of the particles, determined by media mineralogy and physical form.

PRODUCT SELECTION

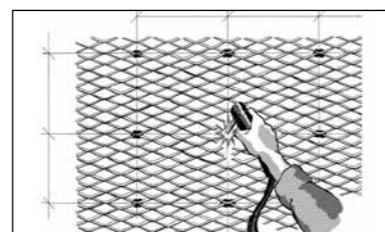
IF THE PROCESS REQUIRES:	... THE OPTIMAL PRODUCT CHOICE IS:
For serial needs.	500 series
Superior wear resistance.	2000 series
Temperature resistance up to 400 °C (750 °F).	Densit® WearFlex Densit® WearCast Densit® WearSpray
Temperature resistance up to 1200 °C (2190 °F).	Densit® WearFlex HT Densit® WearCast HT
Insulation against heat loss by adiation and replacement of refractories.	Densulate

IF THE COMPONENT REQUIRES:	... THE OPTIMAL PRODUCT CHOICE IS:
Overhead wear lining.	Densit® WearSpray
Complex geometry.	Densit® WearFlex Densit® WearSpray
In-situ lining.	Densit® WearFlex Densit® WearSpray
Lining before installation.	All products and Densit® components
Very fast installation.	Densit® WearSpray

Technical specifications

Densit® Standard Wear Protection Products

	Densit® WEAR 500		Densit® WEAR 1000	Densit® WEAR 2000			Densit® WEAR 3000		
Comments	Low temperature Flex	Spray	Low temperature Flex	Cast	Low temperature Flex	Spray	High temperature Cast HT	Flex HT	Low temperature Flex
Description	Trowel product. To use in almost all kind of application. Very good for complex geometry. Fast and easy installation.	Sprayable product. Suited for the protection of larger surface, complex geometry. Very fast installation there reduce the outage time.	Trowel product. To use in almost all kind of application. Very good for complex geometry. Fast and easy installation.	Castable product. To use in pipings/elbows and precast shapes, where in-situ lining is geometrically impractical or would involve extended outage time.	Trowel product. To use in almost all kind of application. Very good for complex geometry. Fast and easy installation.	Sprayable product. Suited for the protection of larger surface, complex geometry. Very fast installation there reduce the outage time.	Castable product for high temperature applications. Excellent for wear/heat protection of piping/elbows and precast shapes, where in-situ lining is geometrically impractical or would involve extended outage time.	Trowel product for high temperature applications. Excellent for use as wear/heat protection in almost all kind of application. Very good for complex geometry. Fast and easy installation.	Trowel product. To use in almost all kind of application. Very good for complex geometry. Fast and easy installation.
Density of material Kg/m³ (lb/ft³)	2400 (150)	2270 (140)	2650 (165)	2950 (184)	2900 (181)	2625 (164)	3050 (190)	2900 (181)	2575 (161)
Hardness Mohs scale	7.0	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0
Compressive Strength MPa (Kpsi)	100 (14.5)	100 (14.5)	200 (29.0)	170 (24.7)	160 (23.2)	110 (16.0)	170 (24.7)	133 (19.3)	130 (18.9)
Flexural strength MPa (Kpsi)	16 (2.3)	15 (2.2)	25 (3.6)	23 (3.3)	20 (2.9)	12 (1.7)	16 (2.3)	15 (2.2)	20 (2.9)
Coefficient of thermal exp.1/°C 1/°F)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)	10x10 ⁻⁶ (5.6x10 ⁻⁶)
Thermal conductivity W/m °C	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	5.0
Maximum service temper. °C (°F)	400 (750)	400 (750)	400 (750)	400 (750)	400 (750)	400 (750)	1200 (2190)	1200 (2190)	400 (750)
Abrasion resist. cm³/50 m²	2.5-3.5	2.5-3.5	1.5-2.0	1.5-2.0	2.0-3.0	0.5-1.0	1.5-2.0	0.5-1.0	0.5-1.0
Erosion resistance min./cm³	55	55	85	140	130	100	170	140	280
Casting Shrinking vol. %	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Chemical composition	% CaO 80 % SiO ₂ 1 % Al ₂ O ₃ +TiO ₂ 1 % SiC < 0.2 % Fe ₂ O ₃ < 0.0002 % Cr ⁶⁺	15 82 1 1 < 0.2 < 0.0002	20 30 48 < 0.7 < 0.0002	18 25 55 < 0.2 < 0.0002	18 25 55 < 0.2 < 0.0002	13 35 50 < 0.2 < 0.0002	6 6 87 < 0.3 < 0.0002	6 6 86 < 0.3 < 0.0002	17 14 7 62 < 0.6 < 0.0002



Densit® anchoring/reinforcement

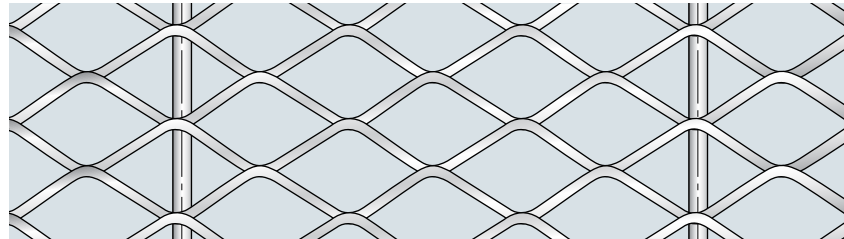
- auxiliary products for use in Densit® wear protection

Steel mesh is used for anchoring of Densit® wear-resistant linings for a range of process temperatures.

The Densit® Anchoring mesh 400 °C is mainly used when installing a Densit® WearFlex or Densit® WearSpray lining, but is also suitable for installing Densit® WearFlex HT in cases where max. operating temperature is limited to 500 °C.

At higher operating temperature Densit® Anchoring mesh 800 °C must be used. Depending on installation situation the mesh must be placed in an appropriate distance from the steel casing.

Further details for choosing the right method of installation at given lining thickness are outlined in the Densit® WearFlex Installation Manual.



PROPERTY	Anchoring mesh 400 °C	Anchoring mesh 800 °C
Material type	Mild steel	AISI 304 L stainless steel
Weight kg/m ² (lb/ft ²)	4.4 (0.9)	2.0 (0.4)
E-modulus GPa (Mpsi)	205 (30)	205 (30)
Maximum service temp. °C (°F)	500 (930)	800 (1470)

When installing the new improved WearFlex products (except HT-products) on expanded metal mesh fibres are generally NOT required.

Fibres protect the wear-resistant lining against settlement cracks and random impact of larger particles. Steel fibres are suitable for use with WearFlex and WearCast products, for

service temperatures up to 1200 °C. WearSpray fibres are suitable for use with WearSpray product, and due to the properties of the polypropylene

material the lining is protected against settlement cracks only.



PROPERTY	Steel fibres 400 °C	Steel fibres 800 °C	Steel fibres 1200 °C	WearSpray fibres
Material	DIN 17140 Werkstoff no. Hardened mild steel	1.4016 Stainless steel	1.4841 Stainless steel	Polypropylene
Length mm (in)	12.5 (0.50)	12.5 (0.50)	12.5 (0.50)	6 (0.25)
Diameter mm (in)	0.4 (0.016)	0.4 (0.016)	0.4 (0.016)	N/A
Thickness µm	N/A	N/A	N/A	35-40
Width µm	N/A	N/A	N/A	100-250
Density g/cm ³ (lb/in ³)	7.8 (0.28)	7.8 (0.28)	7.8 (0.28)	0.9 (0.033)
Tensile strength MPa (kpsi)	1200 (175)	900 (130)	1600 (235)	425 (62)
E-modulus GPa (Mpsi)	205 (30)	205 (30)	205 (30)	13 (1.9)
Ultimate strain %	N/A	N/A	N/A	7
Maximum service temp. °C (°F)	400 (750)	800 (1470)	1200 (2190)	100 (210)



Wear protection for many industries

Densit® wear-resistant linings are especially suitable for protecting processing parts in pneumatic transport and the transport of slurries, and also against wear by bulk solids.

Densit® wear solutions are mainly installed in these industries:

- ✓ Cement and lime.
- ✓ Coal-fired power generation.
- ✓ Steel.
- ✓ Paper.
- ✓ Mineral sands.

UNIQUE SOLUTIONS

Densit® wear protection provides unique solutions to wear problems in many industries by:

- ✓ Increasing lifetime of new and existing components.
- ✓ Increasing safety margins against unscheduled shutdowns.
- ✓ Minimising maintenance costs.
- ✓ Optimising pollution control of plants by reducing particle emissions through exposed wear areas.

WEAR PROTECTION APPLICATIONS

ITW Engineered Polymers provides wear protection solutions which are especially suited to extreme industrial situations where low maintenance costs and minimum shutdown time are critical to the operation.

ITW Engineered Polymers delivers wear-resistant linings for process machinery exposed to erosive wear such as:

- ✓ Cyclones.
- ✓ Ducts.
- ✓ Pipes and bends.
- ✓ Venturis.
- ✓ Chutes.
- ✓ Separators.
- ✓ Mills.
- ✓ Fan casings.
- ✓ Valves.
- ✓ Sluices.
- ✓ Bunkers.
- ✓ Pits.
- ✓ Outlet/cyclones.
- ✓ Hoppers.
- ✓ Back house filters.

TRACK RECORD

ITW Engineered Polymers has more than 30 years' experience in the development and installation of reliable wear protection.

Densit® wear-resistant linings are already standard solutions for specific components within a range of processing industries.

Major system suppliers world-wide use specified Densit® wear-resistant linings in key parts of their processing equipment.

ITW Engineered Polymers provides high performance solutions to customers in accordance with its ISO 9001, ISO 14001 and OHSAS 18001 quality system, certified by Lloyd's Register Quality Assurance.

The appropriate Densit® wear protection is selected according to the specific requirements for each process and component.



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