Fascinating Uses of Heavy Duty Glassflake Coatings in Transport Applications

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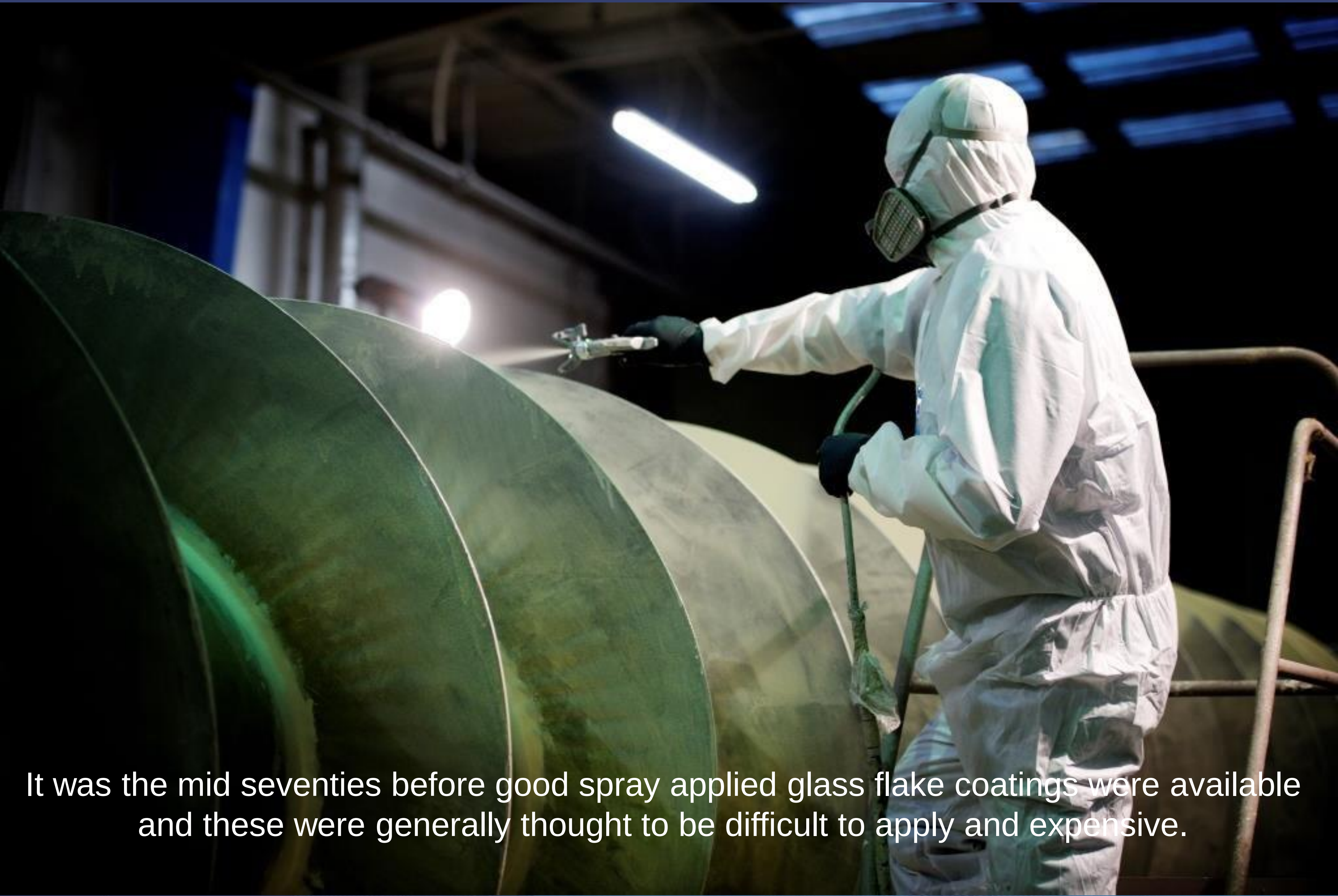
- Development of Heavy duty glass flake coatings
- Glass flake manufacture
- Case studies in transport applications.

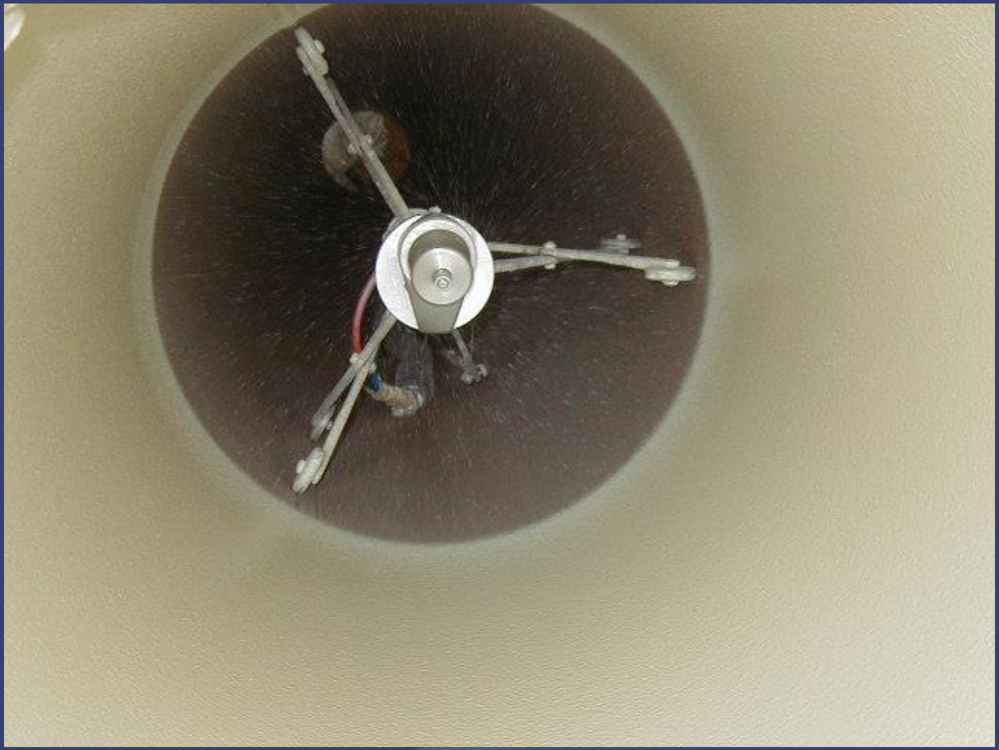
Glassflake Coatings 1960

Glassflake coatings have been available from around 1960. Early glass flake coatings were somewhat crude viscous trowel or brush applied materials.

Glassflake Coatings 1970

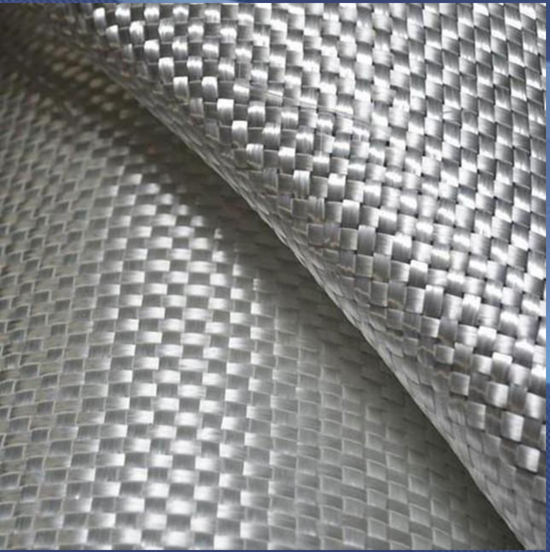


It was the mid seventies before good spray applied glass flake coatings were available and these were generally thought to be difficult to apply and expensive.



These are modern materials being spray applied and an internal pipe spraying application developed in the 90's

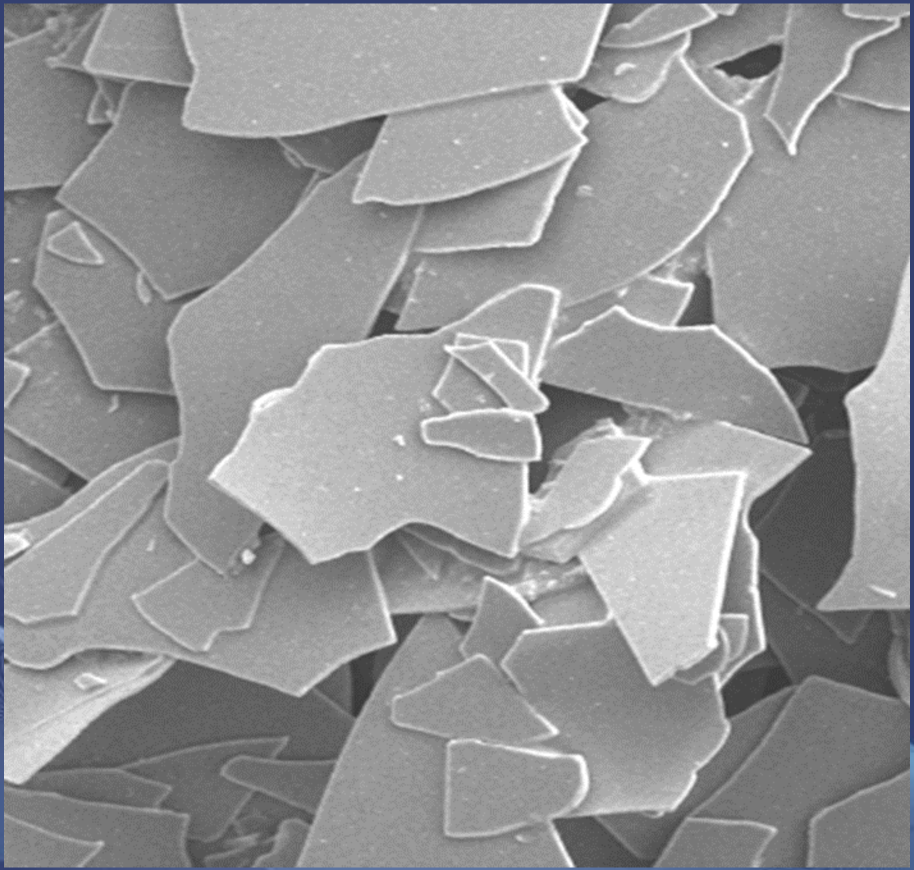
These materials can now be easily sprayed in pipe diameters from 50 mm to over 1 meter, or 4" to over 40"



Glass Flake coatings were produced predominantly with the polyester resins that were used previously for hand lay up of fibre glass, also manufactured with vinyl ester resins for improved chemical resistance. Epoxy formulations containing glass flake only came later and until more recent times were few and far between.

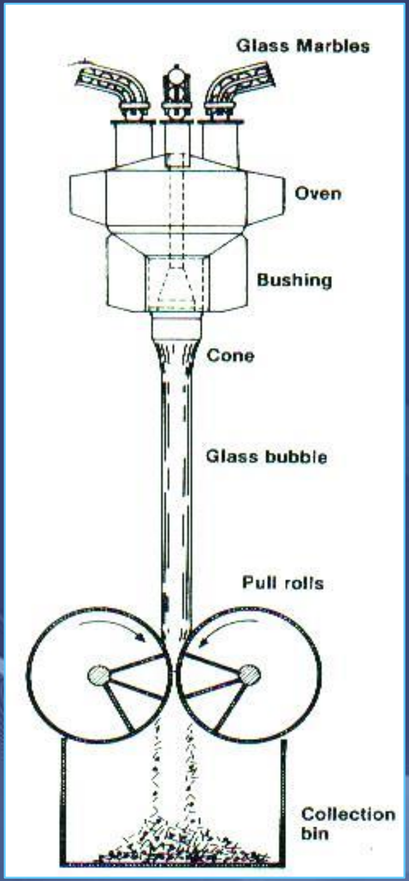
Modern Glassflake coatings can be applied with a standard airless spray pump, have good pot life, hold up and there is now also a material that has an aerosol option.

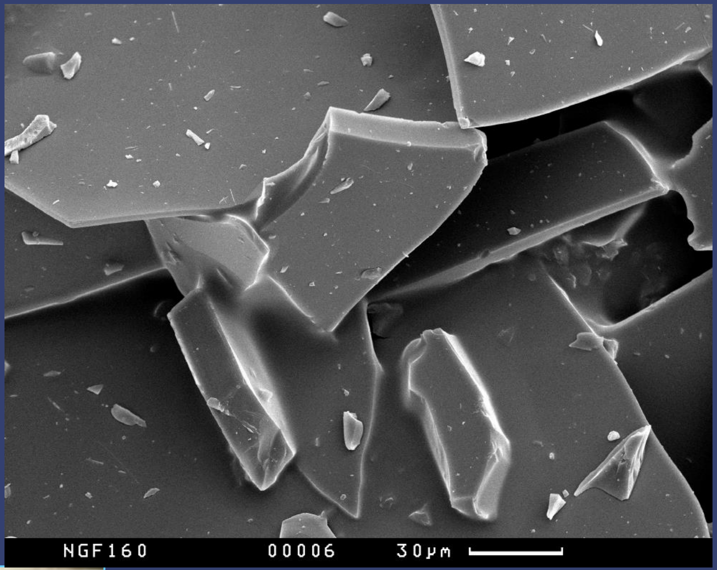
GLASSFLAKE DEVELOPEMENT

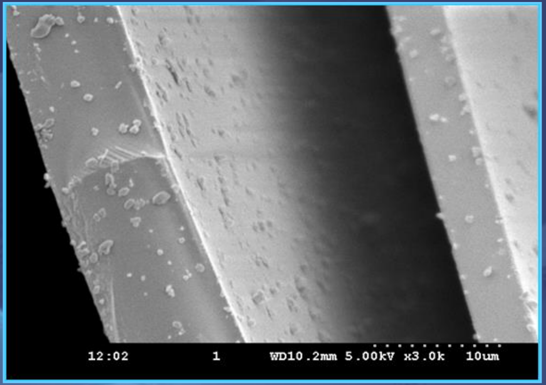


Glassflake developed in the United States in the mid 50’s, initially used for the reinforcement of polyester roof-light panels.
Glass flake replaced glass fibre without reducing light transmission and improved the physical properties.

Conventional Glass Flake Production





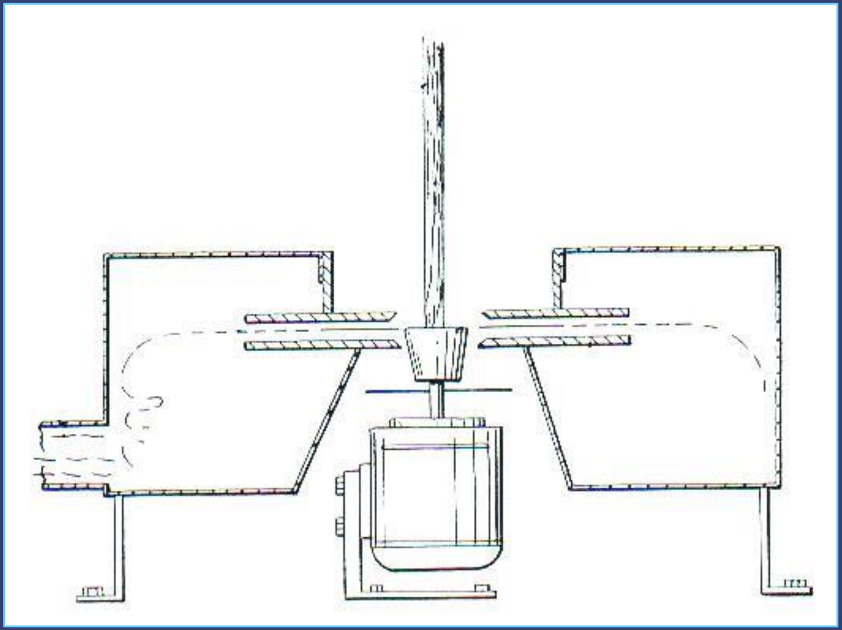


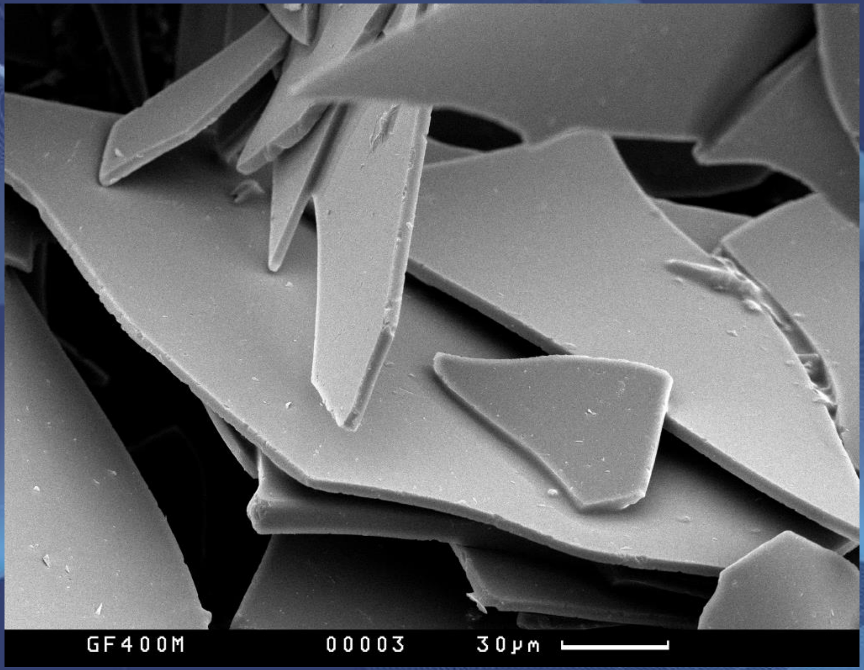
Original manufacturing process is called the bubble method, cost effective, allowing for high throughput production, limitation on control of product parameters. Variance of 2-9 µm

ECR Glass Flake

Advanced manufacturing technology results in a thinner, more consistent uniform glass flake

Flake in the nanometer range can now be produced





An R&D project was started in the UK in 1981, which resulted in a new manufacturing process being invented. The first production of the new glass flake starting in 1983.
The spun glass method has the advantage of tighter product control, typically with thickness deviation at +/-1 micron for a given product, and no curved flake is produced.

SOME PROPERTIES POSITIVELY AFFECTED BY THE ADDITON OF GLASSFLAKE

Vapour and Gas Permeation

Chemical, UV Light, impact and abrasion Resistance

Mechanical properties – Tensile, compressive strength and flexural modulus.

Reduction in Shrinkage

Dimensional Stability – Creep, warp and sag resistance

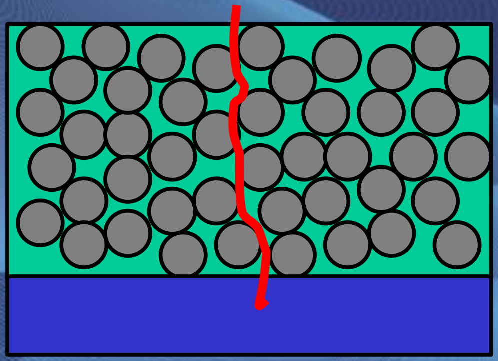
Di-Electric Strength and Electrical Resistivity

Fire Resistance – Reduced smoke emissions and sag resistance in combustion.

Heat Distortion Temperature

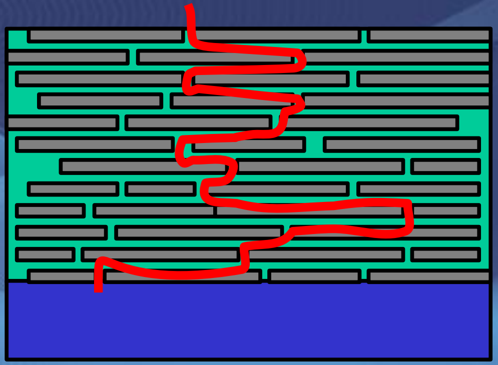
Coefficient of thermal expansion

Granular Filled



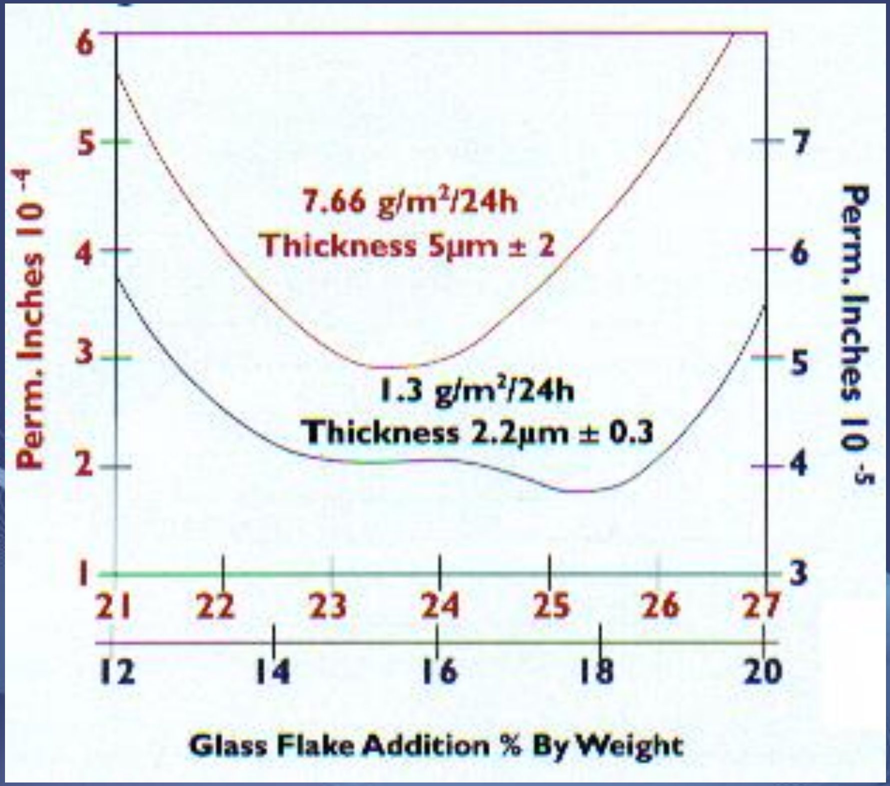
SUBSTRATE

Glass Flake Filled



SUBSTRATE

Comparisons Between Glassflake



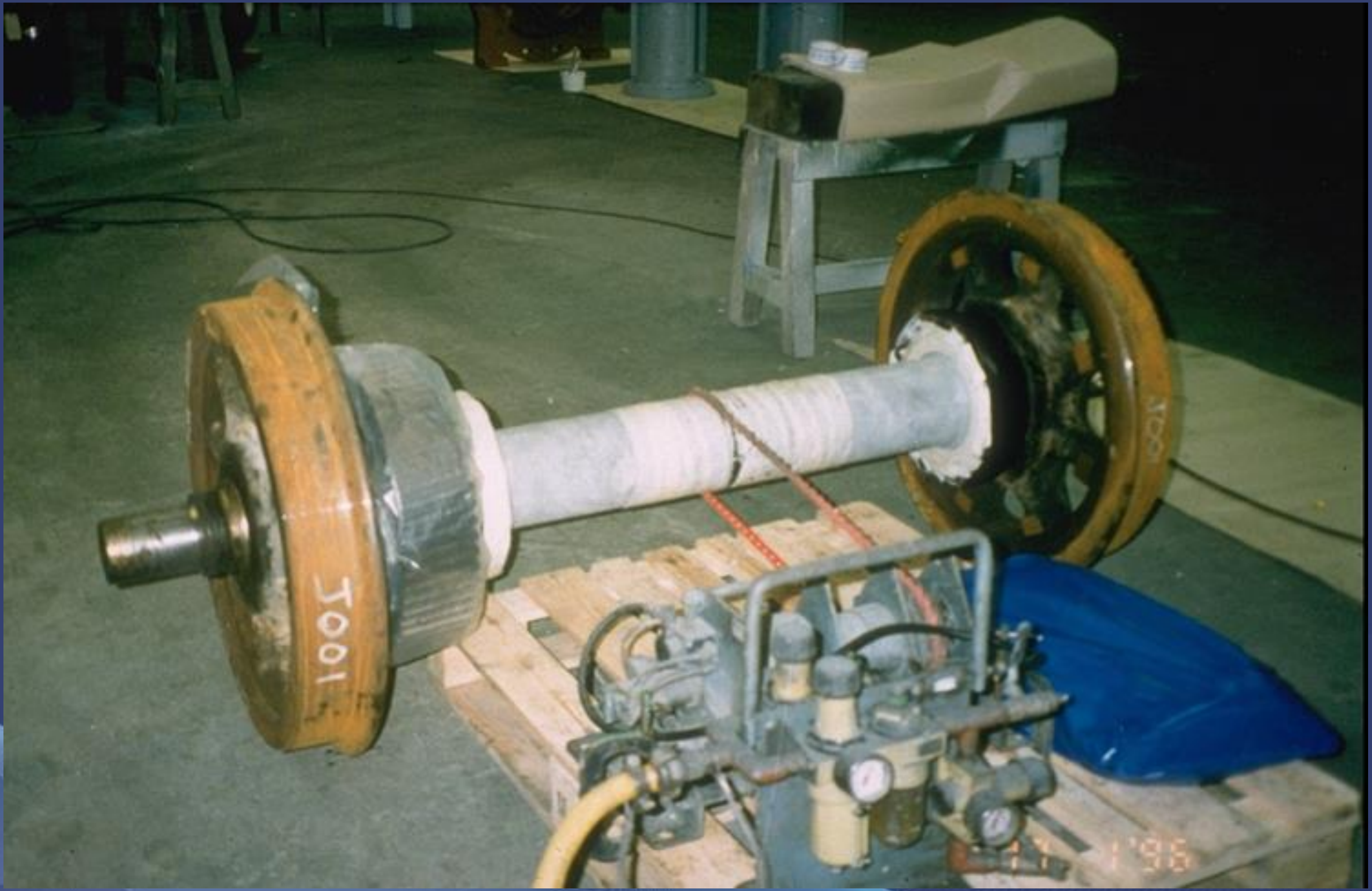
- The optimum percentage of glass will vary depending on the type of glass, percentage of other fillers and type of resin.
- Too much glass flake can be worse than not enough.

Glassflake is now used in lots of other areas outside of the protective coating market such as –

- PTFE gaskets,
- bearings and seals,
- silicone belting,
- composites,
- Polyurethane castable and spray applied.
- Rubber products.
- Engineering thermoplastics,
- commodity plastics,
- GRP and gel coats.
- Paper,
- adhesives and sealants.
- latex carpet backing,
- tyres,
- coated flake for effects pigments
- cosmetics.

CASE STUDY 1

Light train axle tube



Originally the axle tube would be mounted with Bakelite bushings which would compress from composite creep. An engineer had read about the resistance of glass flake materials to creep under compression and sought a solution.

This early application with the axle fully assembled was assisted with the use of an air winch to rotate the axle tube.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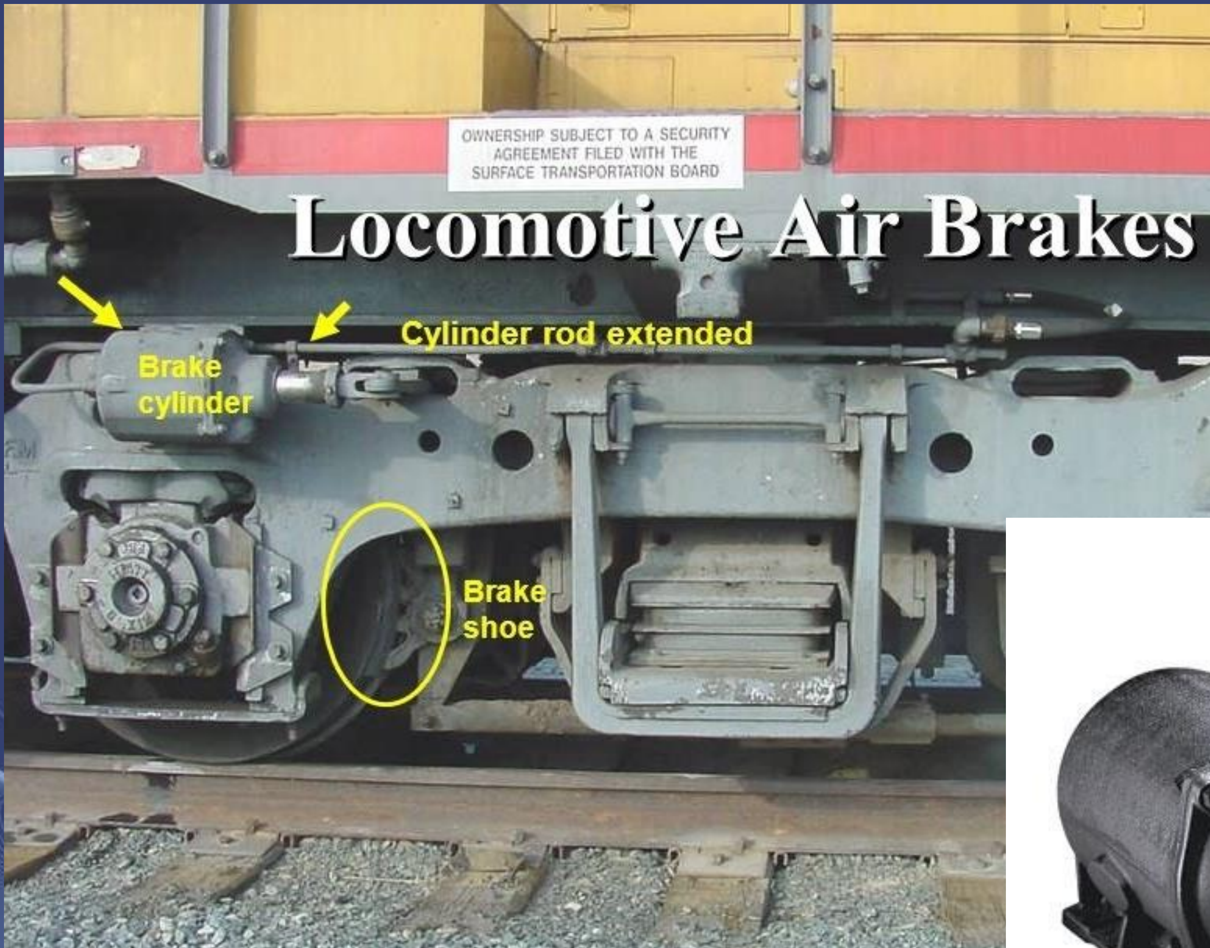
These new parts are pre-machined by 2 mm to allow for the coating composite thickness. The surface is prepared by abrasive blasting, cleaned and then primed by hand.

A multi axial glass fibre cloth is wound into the coating to provide additional crack resistance and spread stress. Following cure the application is post machined to a tolerance of +/- 0.1 mm

The main properties required by this application were electrical resistance, resistance to composite creep under compression and cross dimensional stability to allow machining to close tolerance.

CASE STUDY 2

Train air brake cylinder.



Westinghouse Air Brake Company
locomotive air brake cylinder.

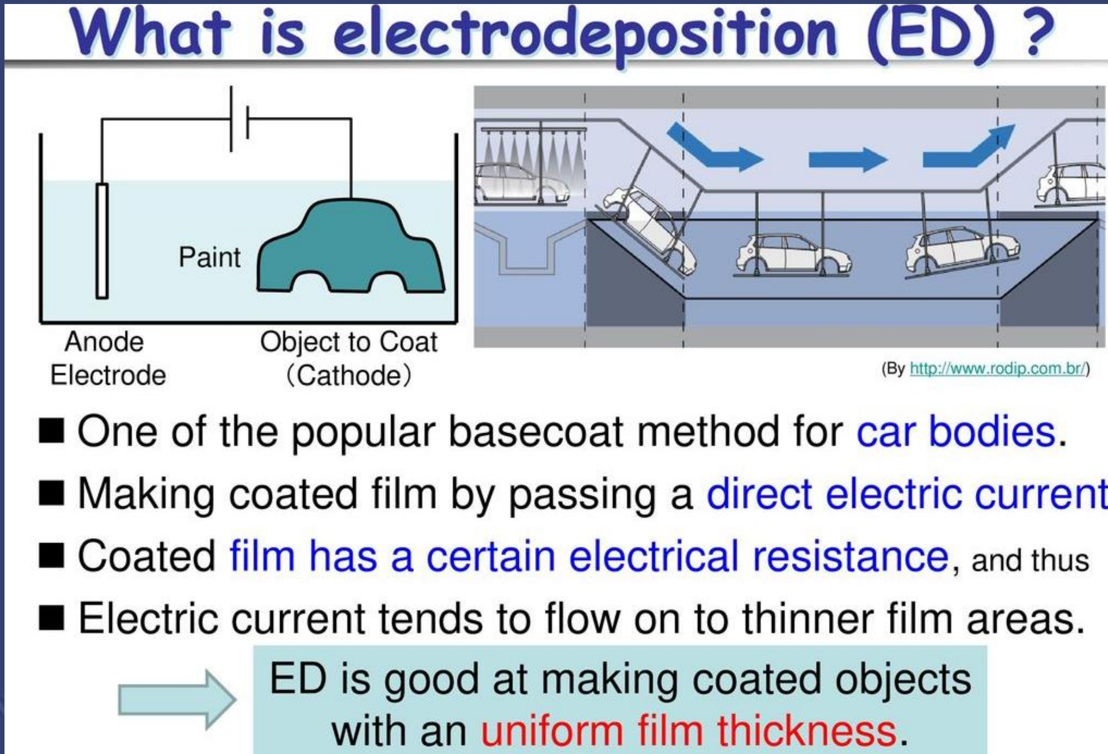
Over time the cylinder bore suffers wear beyond tolerance which results in a leaking cylinder. The component is pre machined to allow the coating thickness to be applied.

A low viscosity material applied by a spinning method, before being machined to a tolerance of +/-.05mm following sufficient cure.
The main properties looked for in this application are good cross dimensional stability, resistance to creep and sliding wear resistance

CASE STUDY 3

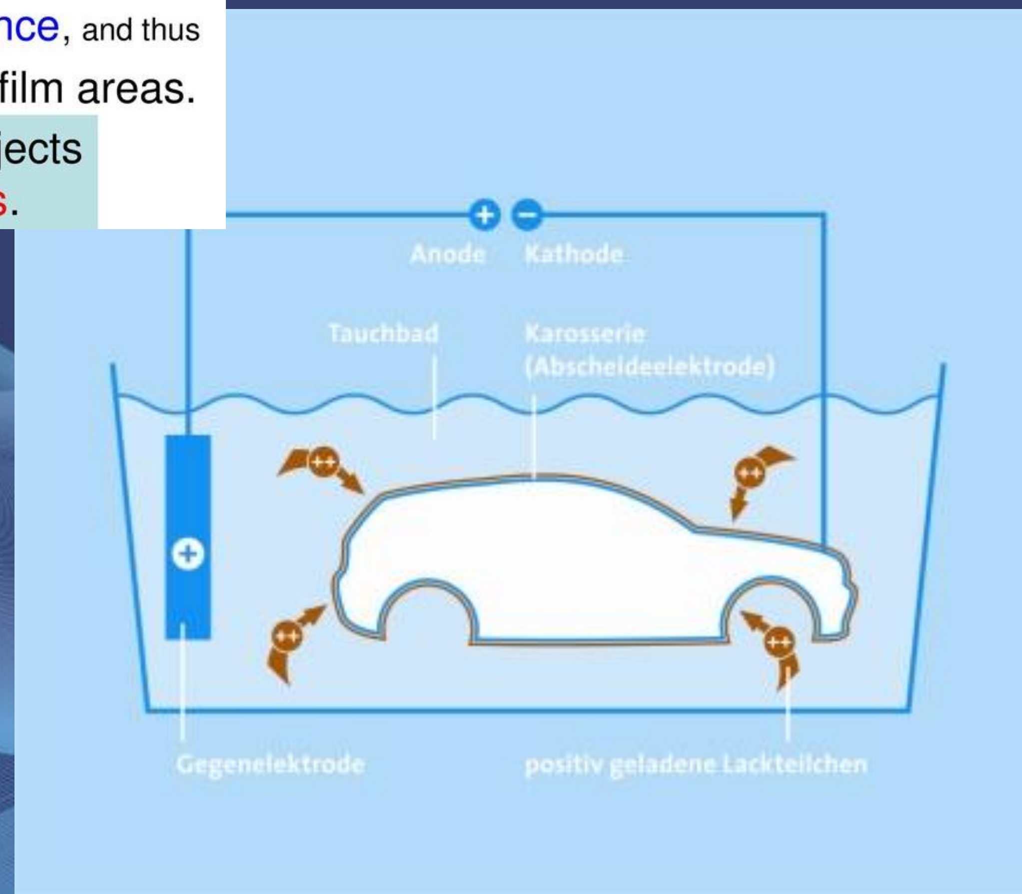
Cathodic dip tanks

KTL tanks, cathodic dip tanks also sometimes called electrocoat or Elecro Deposition tanks are used to apply paint, mainly to vehicle bodies. Water based.
Temperature: 28ºC - 40ºC - pH: 5 - 6
On average 77 Car bodies per hour.
This would not be considered a highly corrosive environment.



The car body, becomes a cathode with a negative charge.

The coating's binder particles are the cations and have a positive charge. The coating particles migrate toward the steel panels with the aid of an electric current and are deposited.

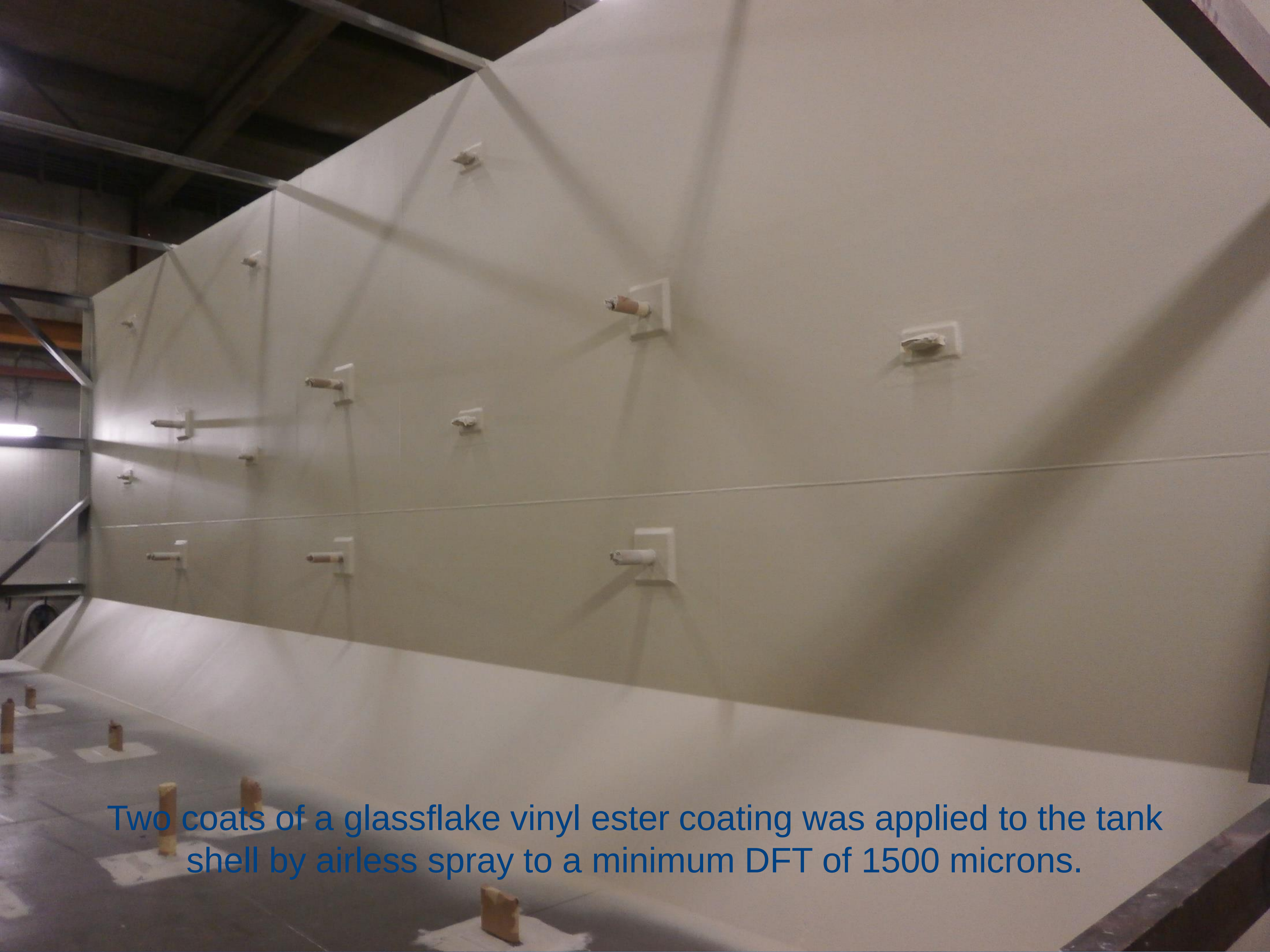


This is a section of a 40 meter long Cathodic Dip Tank which was fabricated in four 10 meter sections in Europe before bieng shipped to the Tesla production facility in California.

Following surface preparation a holding primer with a long overcoating time was applied to allow the marking up and adhering of plastic brackets and pipe supports to the tank shell.

Industrial magnets were used to help secure the brackets in place until the coating material adhesive had cured.

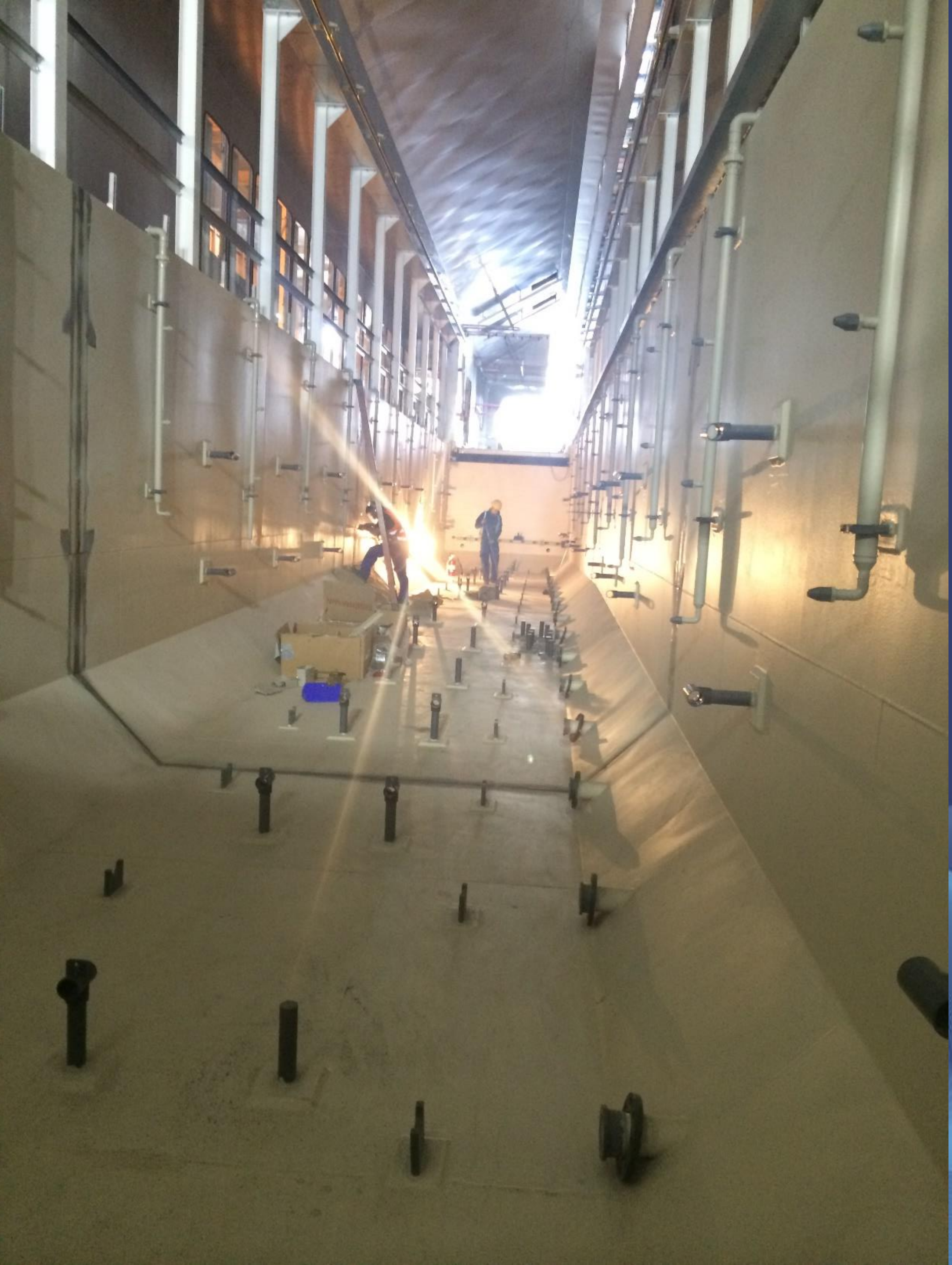
Following cure the brackets and supports were also laminated with glass fibre matting prior to stripe coating.



Two coats of a glassflake vinyl ester coating was applied to the tank shell by airless spray to a minimum DFT of 1500 microns.

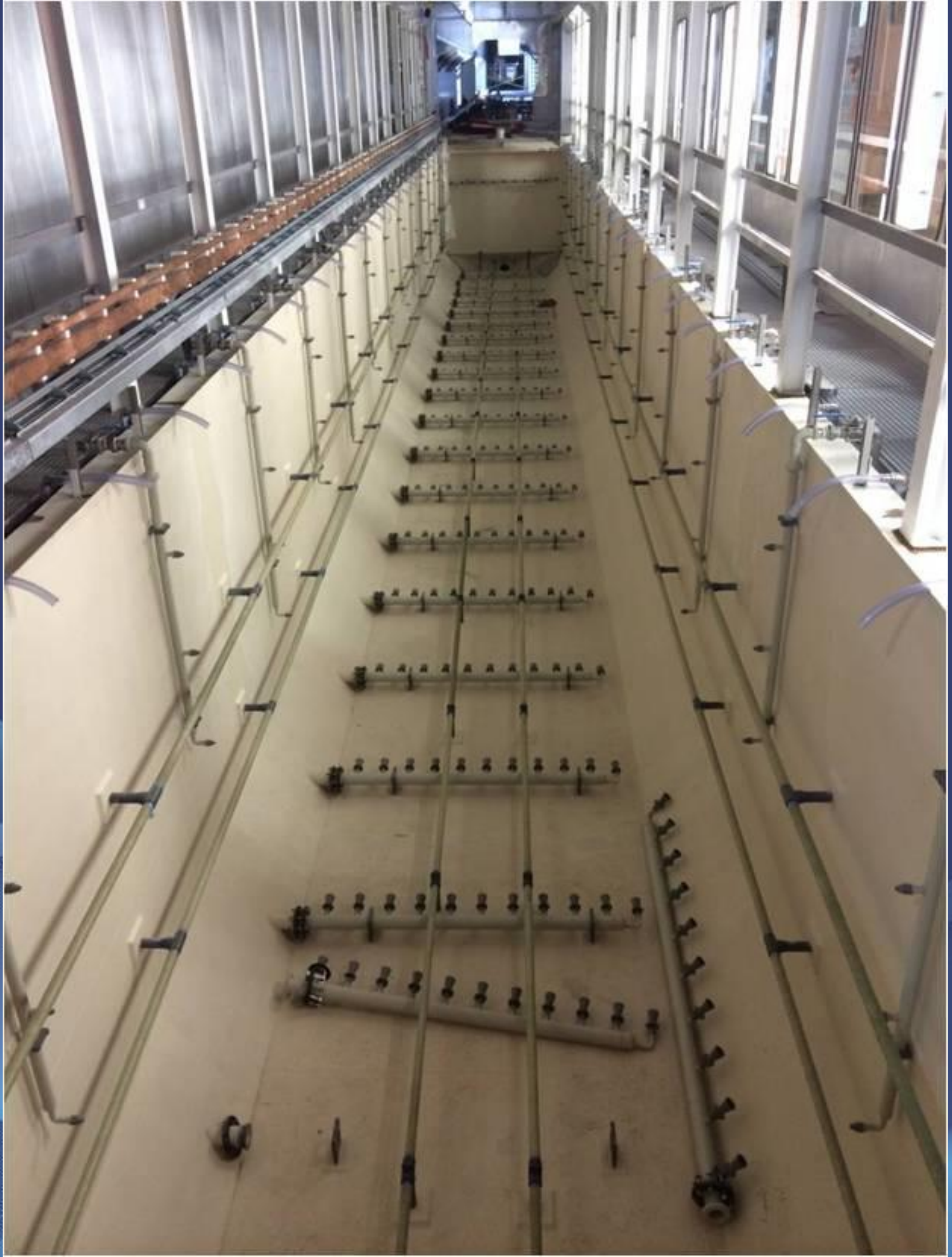

Spark testing was carried out at 15 kv, this was specified by the client as a minimum resistance required to allow insulation of the steel shell.


HOVELMANN
STRAALBEDRIJF
GEBR. CUIJPERS



The sections welded together on site. Note the field fit weld joint, which was still to be repaired when this photo was taken. Typically an area of 100 mm on each side is sufficient to prevent thermal damage to the coating from the welding process.

The fitting of all the internal pipes for e-coat distribution and protective rails to prevent impact damage to the tank by the car bodies.



The main selection criteria for a glass flake coating in this environment was for dielectric strength and electrical resistivity.

CASE STUDY 4

Ships propeller shaft

PROPELLER SHAFT

ΕΛΛΗΝΙΚΟΣ ΝΗΟΓΝΩΜΩΝ

HELLENIC REGISTER OF SHIPPING

21560/05/PEA

TYPE APPROVAL CERTIFICATE

FOR

METHOD OF PROTECTION OF STEEL PROPELLER SHAFTS EXPOSED TO SEAWATER

This is to certify that the protection method of shafts exposed to seawater, particulars of which are given below, is an approved alternative of the continuous liner on ships classed or intended to be classed with this Society for the protection of the steel propeller shafts with respect to the requirements of Part 1, chapter 3, par.15.1.1 of HRS Rules concerning the five (5) years survey periodicity of propeller shafts by removal from their stern tube.

Particulars of steel Propeller Shaft Protection Method

The areas coated on the shaft are additionally reinforced with quadraxial glass fibre matting, to spread stress. This was applied in three layers with a total system thickness of 2.5 mm.

SUMMARY

- Heavy duty glass flake coatings
- Glass flake manufacture
- Case studies in transport applications.

To demonstrate other uses of heavy duty glass flake coatings in transport applications with engineering repairs or where corrosion protection in immersed envoronments was not the primary selection criteria.

Questions?