TECHNICAL DATA SHEET

ShieldCrete®

ShieldMining™ TSL

Two Component, Tough, Non-combustible, Resilient, Rapid Curing Spray Lining

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Product Description

ShieldMining™ TSL is a unique new generation Thin Skin Lining (TSL) designed specifically for the consolidation of stressed rock structures associated with mining to prevent unravelling of strata and the associated risks presented from falling ground. It also has potential for use as a fire-retardant coating for various substrates. It is a two-component hard, tough, resilient material that is applied through low pressure plural component machinery with a static mixer. No heat is required. The product is flexible with good elongation and high early compressive and tensile strengths. Adhesion is outstanding to even moist surfaces. 60 to 70% of the physical properties are achieved in 1-2 hours (depending on ambient temperature) although set up time is only 10-15 minutes.

Features

- ✓ High tensile strength: capable of holding together under extreme loading conditions.
- ✓ High impact strength.
- ✓ Compressive strength: approximately 10 MPa after 30 minutes.
- ✓ Outstanding adhesion: bonds to all (rock, coal, concrete) surfaces.
- ✓ Fire Resistant
- ✓ Approved for use in underground coal mines.
- ✓ Cream colour for good light reflectance.
- ✓ Water based: clean up with water, no flammable volatiles.
- ✓ No dust
- ✓ No raw material handling: no requirement to be handled other than connecting hoses to the material containers, drums or 1000 litre IBC's.
- ✓ No batch mixing -no cement or aggregates or polymer additives required.
- ✓ Applied at 5-10 mm thickness.
- ✓ Can be applied by hand gun or robotic spray apparatus.

Application Areas

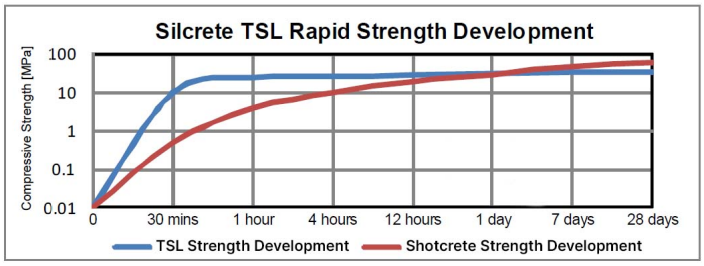
- ✓ Rock support in tunnels and mines
- ✓ Suitable for lateral work and in shafts
- ✓ Slope stabilisation
- ✓ Grouting applications
- ✓ Soil stabilisation in poor ground conditions
- ✓ Consolidation
- ✓ Mesh replacement
- ✓ Ground support for areas with difficult access
- ✓ Assists with hard rock strain bursting
- ✓ Pillars/rib support
- ✓ Rehabilitation of collapsed areas
- ✓ Long wall installation and recovery
- ✓ Portal construction
- ✓ Protection from weathering
- ✓ Ventilation stoppings
- ✓ Ventilation improvement by reduced surface friction
- ✓ Sealing against goaf ventilation to avoid spontaneous combustion.

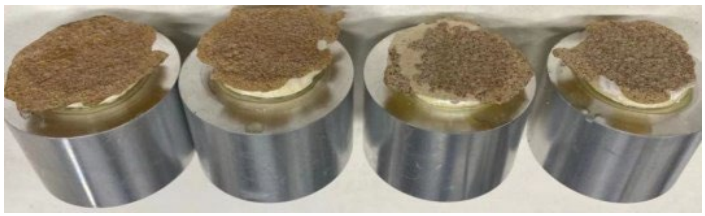
Product Data

	TSL PART A	TSL PART B
Appearance	White, hazy liquid	Brown, translucent liquid
Viscosity at 23°C	600-900 cps	500-600 cps
Specific gravity at 23°C	1.5 g/ml	1.16 g/ml
Mix Ratio	1A:1B by volume	

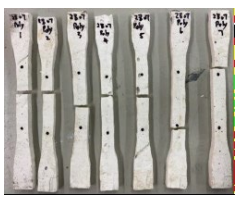
Performance and Cured Properties Data

Curing time to put into service	1-2 hours
Compressive Strength	10 MPa after 30 minutes 35 MPa after 5 days
Tensile Strength	7.8 MPa
Elongation	5-10%
Thermal Conductivity (ASTM C518-2010)	0.1823 W/m.K

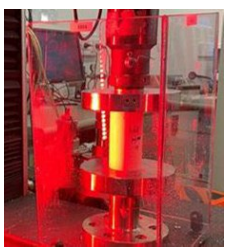




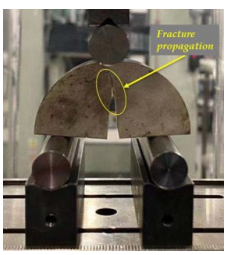
ADHESION TESTING SHOWING SUBSTRATE FAILURE



Dog-bone Samples from Tensile Testing



Uniaxial Compressive Strength Testing

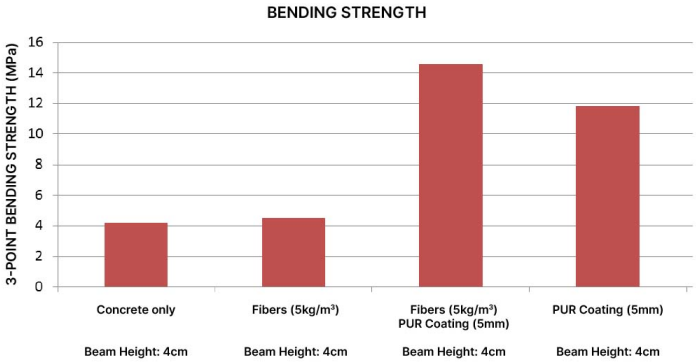


Fracture Toughness Test

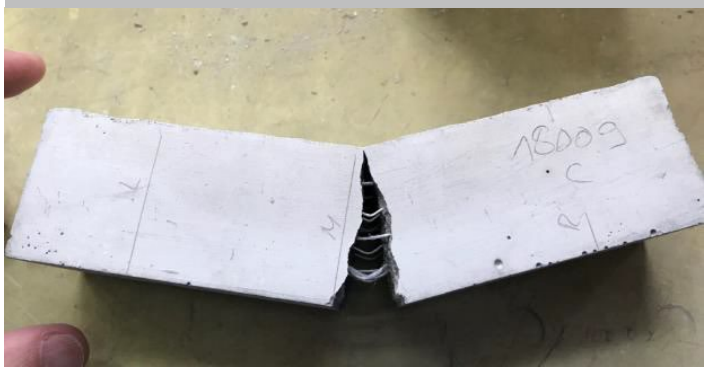
PHYSICAL PROPERTIES	TEST CONDITION	ShieldMining™ TSL
Uniaxial Compressive Strength (MPa)	ASTM D7012	36.2
Point Load Strength Index (MPa)	ASTM D5731	4.2
Direct Tensile Strength (MPa)	ASTM D3967	7.8
Elastic modulus (MPa) (strain < 2.86%)	-	374.37
Elastic modulus (MPa) (strain ≥ 2.86%)	-	73.26
Elastic modulus (MPa) (strain < 2.0%)	-	512.62
Elastic modulus (MPa) (strain ≥ 2.0%)	-	117.42
Poisson's ratio (strain < 2.0%)	-	0.50
Poisson's ratio (strain ≥ 2.0%)	-	0.68
Fracture Toughness (MPa $M^{1/2}$)	-	1.0
Punch Shear (kN)	ASTM D732	13.7
Adhesion (MPa)	ASTM D4541	> 3.7 (substrate failure)

Bend Strength on Concrete

Approximately 300% improvement with Silcrete TSL



Without ShieldMining™ TSL



Without ShieldMining™ TSL

MSTC Compliance Testing

Silcrete TSL has been tested by the Mine Safety Technology Centre (MSTC) and complies with the requirements of MDG3608.

TEST MDG3608	METHOD OF ANALYSIS	COMPLIES
Maximum Exothermic Temperature	Appendix D1	✓
Electrical Resistance	Appendix D2	✓
Fire Resistance	Appendix D3	✓
Fire Propagation	Appendix D4	✓
Flashpoint	Appendix D5	✓
Oxygen Index	Appendix D6	✓
Chemical Characterisation of Components	Appendix D7	✓

Safety and Handling

ShieldMining™ TSL Part A is considered practically non-toxic, the usual precaution for handling chemicals should be exercised. Protective clothing should be worn and contact with the body avoided.

ShieldMining™ TSL Part B should be treated as a diisocyanate and the usual precautions should be exercised when handling this family of chemicals. Protective clothing should be worn and contact with the body avoided. Inhalation of spray aerosol must be strictly avoided and a protective mask, preferably with a clean air supply should be worn in the immediate spraying area.

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Storage and Stability

ShieldMining™ TSL Part A storage life of 12 months from date of manufacture when stored at in-door ambient conditions (15-35°C) in unopened containers.

ShieldMining™ TSL Part B is a diphenylmethane diisocyanate and will react with moisture generating carbon dioxide. The containers should be stored with the seals intact and opened containers used first. The reaction with moisture/water can lead to dangerous build-up of pressure in the drums. Therefore, partially used containers must be tightly re-sealed after use to prevent ingress of moisture. Do not reseal containers once the contents have been used. Storage life of 12 months from date of manufacture when stored at in-door ambient conditions (15-35°C) in unopened containers. It is strongly advised to purge with dry nitrogen during use.

Processing and Instructions for Use

These materials must be handled and applied only by trained operators.

ShieldMining™ TSL is applied through a suitable plural component pump system direct to the rock face either by handgun or robotic arm application. For hand spray application, we recommend application equipment such as SK90, PG30/40 pneumatic gear pumps, hydraulic gear pumps or double action piston pumps such as Graco Reactor 2 E-XP2 or Reactor H-XP3. A continuous positive pressure, surge free delivery is required for best results.

The part A component requires thorough mixing and recirculation prior to use. We recommend the use of continuous agitation of the Part A component during application.

It is essential to concentrate the sprayed material into all cracks and fissures to "lock up" lose strata.

The material is thixotropic as it leaves the spray head which eliminates drainage and sagging and ensures the material stays were sprayed into cracks etc. The material is set up and tack free in 10-20 minutes depending on ambient temperature.

The liner can be drilled through and if required rock bolts installed after 60 minutes.

For applications where extreme temperature conditions make application difficult, the reactivity can be adjusted to suit these conditions. Consult RMP technical team for advice.

Application Coverage Rates

DRY FILM THICKNESS	LITRES PER SQM
6mm	6.0L/m^2
8mm	8.0L/m^2
10mm	10.0L/m^2

Packaging

PACKAGING	A	B
20L Pails	30 kg	23kg
60L Drums	90 kg	70kg
200L Drums	300 kg	232kg
1000L IBC	1500 kg	1160kg

20 litre pails, 60 and 200 litre drums, and 1,000 litre IBC's.

Technical Support

For technical support, please you may send an email to mail@shieldcreteinternational.com.

DISCLAIMER

The information provided herein, especially recommendations for the usage and the application of our products, is based upon our knowledge and experience. Due to different materials and equipment used, as well as varying working conditions and environments beyond our control we strictly recommend carrying out intensive trials to test the suitability of our products regarding the required processes and applications. This data sheet is provided free of charge, and we do not accept any liability regarding the above information or regarding any verbal recommendation, except for cases where we are liable of gross negligence or false intention.