SEPPIC

SEPIGEL™ H 200 LWT

Ultimate signal transmission protection

Ingredients that inspire

SEPIGEL™ H 200 LWT

Filling gel for fiber optic cables that protects its useful lifetime.

Chemical protection:
With efficient hydrogen scavenger agents, it helps to improve the fiber optic cable reliability.

Mechanical protection:
Sepigel H 200 LWT is a thixitropic gel:

- Fluid under stress for convenient manufacturing conditions:
  - Easy to pump at room temperature.
  - Easy to inject into the cable.
- Viscous at rest:
  - As soon as the filling gel is introduced into the cable, it regains its viscosity.
  - Provides mechanical protection to the fiber optic cable while still allowing its free movement so there are no constrains that could cause damage.

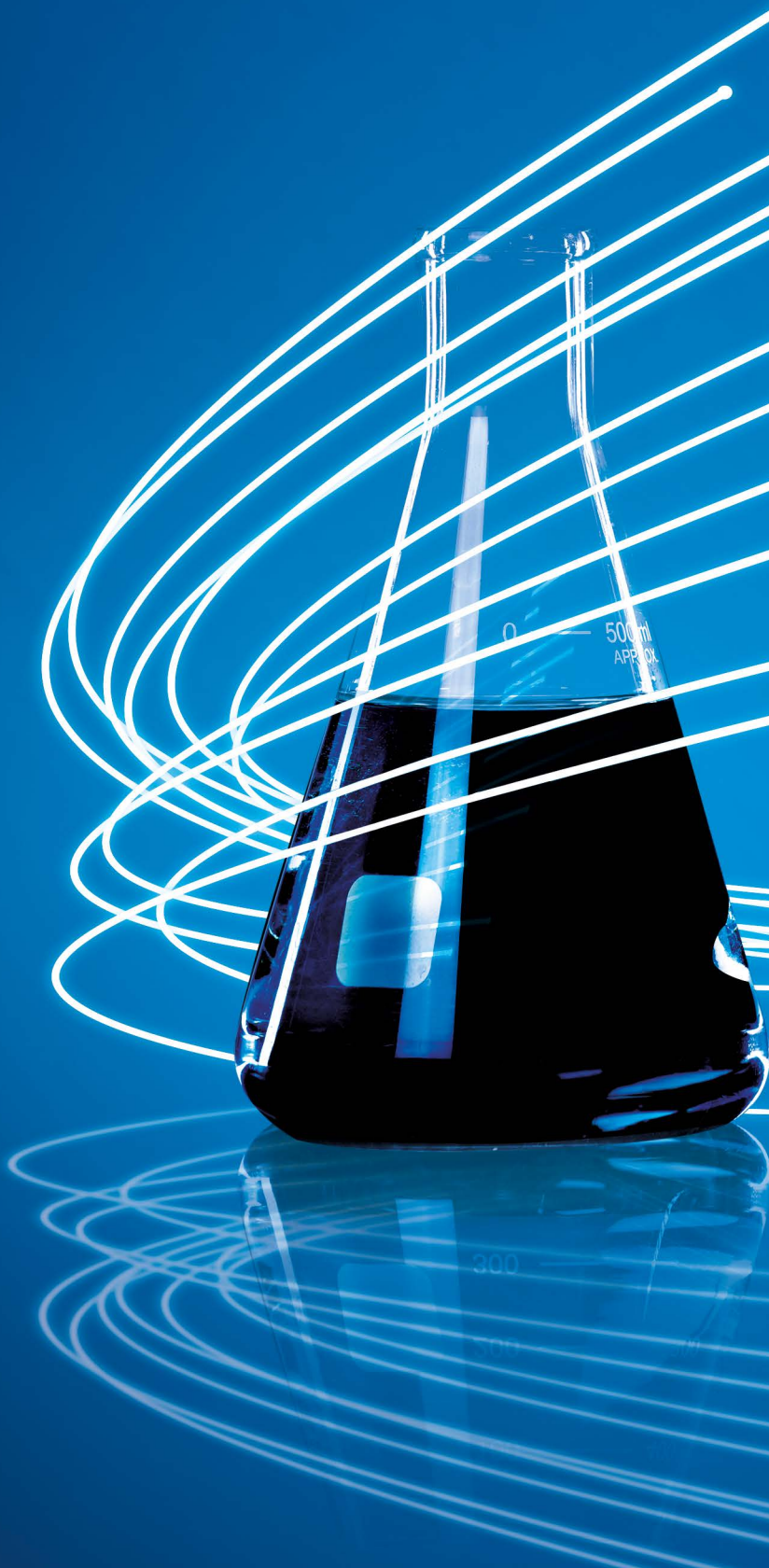
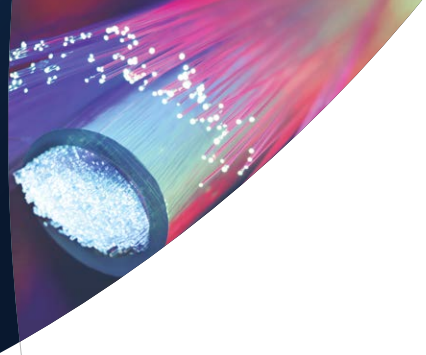


Table of contents

FIBER OPTIC CABLE USEFUL LIFETIME



Importance of an efficient filling compound to ensure the useful lifetime of the cable

The light impulses travel along the optical fiber made mainly of pure amorphous silica a-Si. The objective is to minimize the signal attenuation. In order to do so, the silica must be protected to remain undamaged during the manufacturing, installation and useful lifetime of the cable.

The filling compound **SEPIGEL H 200 LWT** is the ultimate protection of the fiber as it surrounds it at the core of the cable.

SEPIGEL H 200 LWT:

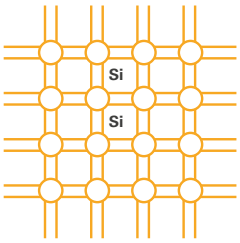
1. Facilitates the process of introducing fibers into the stainless steel tube.
2. Protects the fibers from mechanical stress.
3. Prevents chemical attack of the fiber optic cable by water, oxygen or hydrogen.

A major consequence of hydrogen presence in the fiber optic cable is an increase of signal attenuation, particularly for signals being transmitted with wavelengths over 1µm. The signal may be disturbed in different ways:

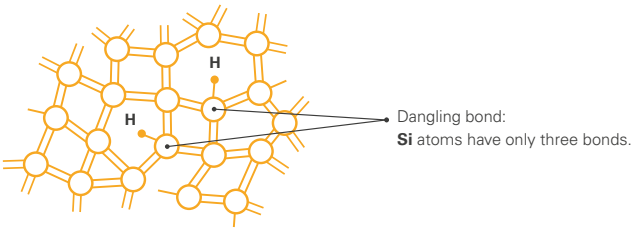
- Hydrogen, when diffused into the optical fibre, is able to absorb energy, with an adsorption spectrum comprising the wavelengths covered in the optical signal.

- Hydrogen can react with the silicon or with some components of the fiber used as dopants: SiO_2, GeO_2 or P_2O_5. Causing unacceptable increase in attenuation.

Cristalline silicon



Amorphous silicon



SEPIGEL H 200 LWT has been the reference filling gel used since 1994 by the major producers of fiber optic cables.

Hydrogen may be generated from parts of the cable itself or from external sources. During manufacturing, it is generated during the laser welding process. Once the cable is installed, hydrogen may be released over the years from the chemical degradation of metallic or plastic materials that oxidize in presence of water.

Hydrogen diffuses easily through most materials. Once hydrogen is inside the fiber optic cable, although it diffuses easily, the rate of elimination is highly reduced because of the presence of a lot of impermeable barriers such as plastic sheaths or metallic tubing. Also, diffusion of hydrogen out of the cable depends on surrounding conditions. Air produces a negligible resistance for optical ground wires but for water proof cables such as submarine cables, high pressures in the deep sea environment prevents hydrogen diffusion out of the cable. Partial pressure of the H_2 increases and the result is an increase of the amount of interstitial hydrogen that may reach the optical fibers. The higher the partial pressure is, the longer the fiber is exposed to hydrogen and the greater is the risk of damage. Therefore, an efficient hydrogen scavenger is needed for an optimal signal transmission and to guarantee the durability of the fiber optic cable.

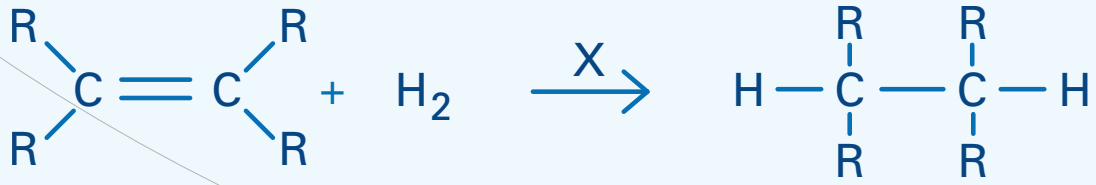
SEPPIC's filling compound **SEPIGEL H 200 LWT** prevents the hydrogen from reaching and irreversibly damaging the fiber optic cable though two mechanisms:

1. Adsorption of the hydrogen by the metal catalyst compounds dispersed in the gel.
All together, the SEPIGEL H 200 LWT contains the highest concentration of hydrogen scavenging agents among the filling gels on the market.

$$X + H_2 \rightarrow [X]H_2$$

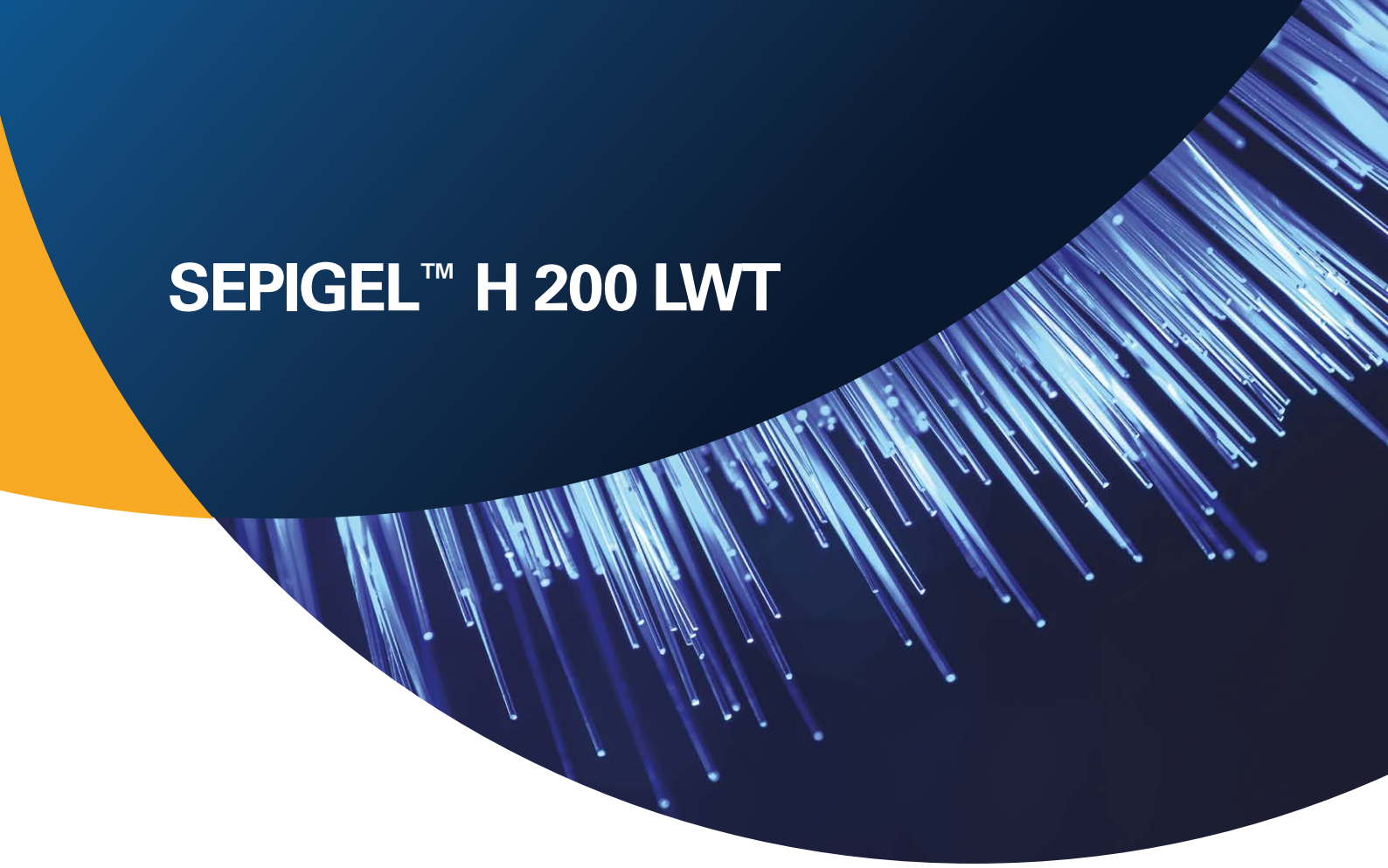
Metal catalyst included in SEPIGEL H 200 LWT → *Metallic Hydrate trapped inside SEPIGEL H 200 LWT*

2. Hydrogenation of unsaturated carbon bonds present in the gel.



SEPIGEL H 200 LWT hydrogen scavenger agents

SEPIGEL™ H 200 LWT



General description

- Filling compound for fully sealed fiber optical cables.
- Contains efficient hydrogen scavenging agents, providing a high hydrogen adsorption capability to extend the cable's usefull lifetime.
- Hydrophobic and thixotropic gel to simplify the injection during the production of the cables.
- Easy to pump even at room temperature. The most convenient pumping unit is a Multi Piston Pump (MPP), as it is able to deliver a constant flow at high pressures.
- Produced since 1994 at the SEPPIC's site located in Castres, France, which is qualified ISO14001, ISO9001, and OHSAS 18001.

Specifications

CERTIFICATE OF ANALYSIS

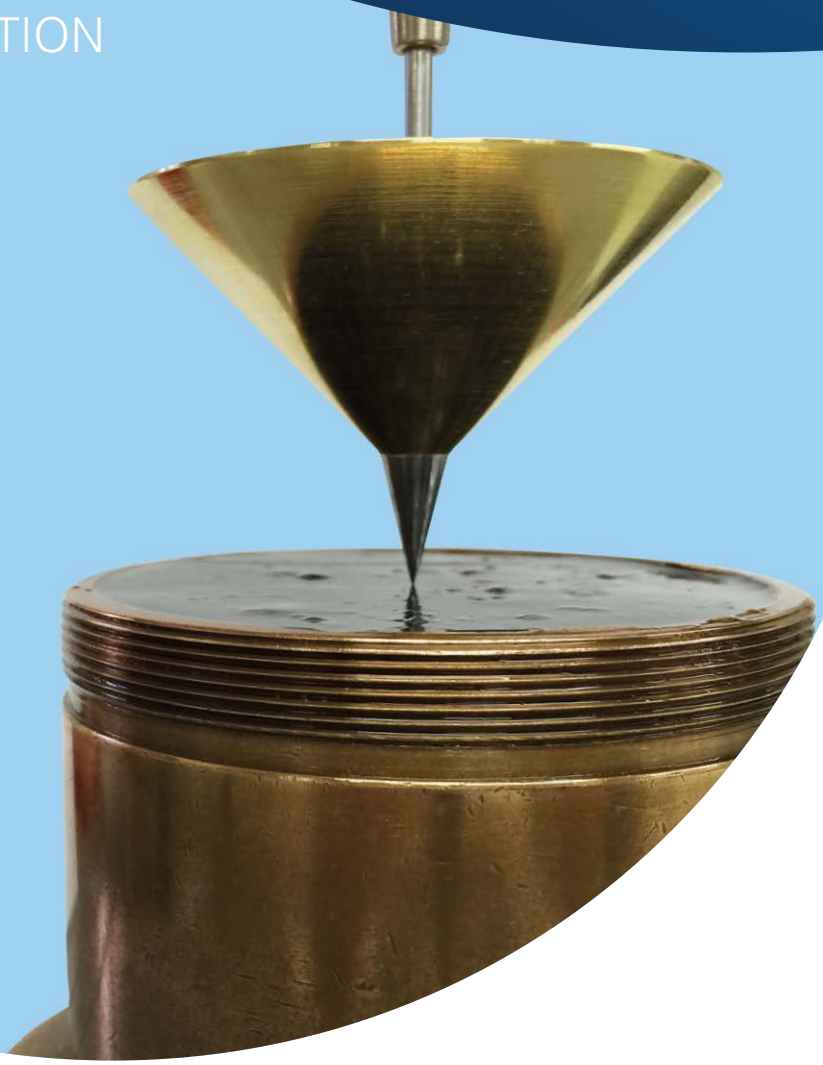
The Certificate of Analysis (COA) issued with each delivery guarantees the following characteristics:

- **Appearance:** black compound with a soft grease consistency.
- **Oil bleed and volatility** is the loss in weight by bleeding and evaporating at a temperature of 150°C (302°F).
- **Cone penetration** is the depth reached by a standard metallic cone released under given conditions of temperature. Measurements are performed at 25°C (77°F) on a sample that has been worked, which means that the gel has been under continuous movement. Once at rest, sample of worked-product is analyzed straight away and the another one after 24 hours at rest.
- **Plastic viscosity** is the viscosity measured with a rheometer at the highest possible speed (shear rate). This condition roughly corresponds to the one during injection of the filling compound into the cable. The measurement is done at controlled temperature of 25°C (77°F).
- **Hydrogen adsorption** is measured by the loss of pressure within 24 hours inside a sealed tube filled with hydrogen containing **SEPIGEL H 200 LWT** at standard temperature and pressure (STP).

CHARACTERISTIC	CONDITIONS	SEPPIC METHOD	SPECIFICATION	UNITS
Appearance	-	Visual	Black soft grease	-
Oil bleed	24h - 150°C (302°F)	52 - 129	0.6 max	%
Volatility	24h - 150°C (302°F)	52 - 129	3 max	%
Cone penetration	worked product	52 - 128	350 - 410	1/10 mm
	worked + 24 hours storage	52 - 128	340 - 400	1/10 mm
Water content	-	52 - 099	400 max	ppm
Hydrogen adsorption	After 24 hours at STP	52 - 228	0.5 - 2.0	ml/g
Plastic viscosity	25°C (77°F)	52 - 229	1.5 - 3.0	Pa.s

OIL BLEED

CONE PENETRATION



TYPICAL CHARACTERISTICS

- **Acid value:** expresses content of free mineral or organic fatty acid. It is calculated in milligrams of potassium hydroxide (KOH) required to neutralize free fatty acid in 1 gram of product.
- **Dropping point:** the gel is in a cone that is heated up until the gel falls down.

CHARACTERISTIC	METHOD	SPECIFICATION	
Total hydrogen adsorption	58 016	3.5 to 4 $cm^3 H_2/g$ of Sepigel H 200 LWT at STP	
Acid value	52 1904	< 0,6	
Dropping point	NFT 60 102 - ASTM D 566	Approx. 200°C	Approx. 392°F
Flash point (closed up)	NFT 60 103 - ASTM D	>150°C	>300°F
Electrical conductivity	Conductimeter (WTW and 325/S electrode)	0.00 µS/cm	

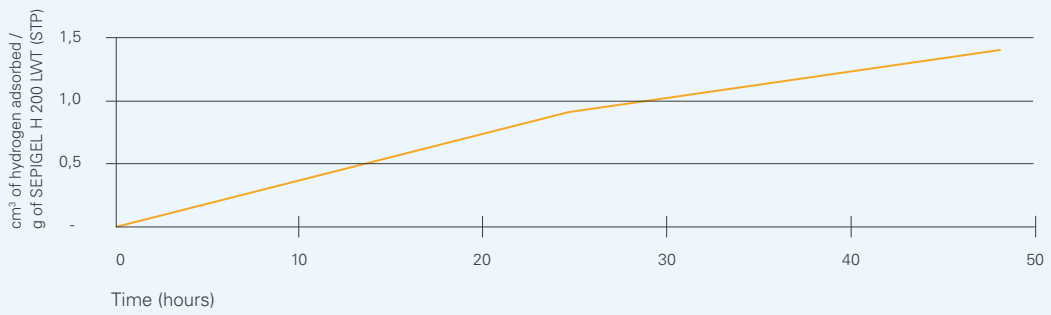
Seppic methods are derived from NFT or ASTM protocols; if you require further details, please contact us at **PerformanceMaterials.SEPPIC@AirLiquide.com**

Properties

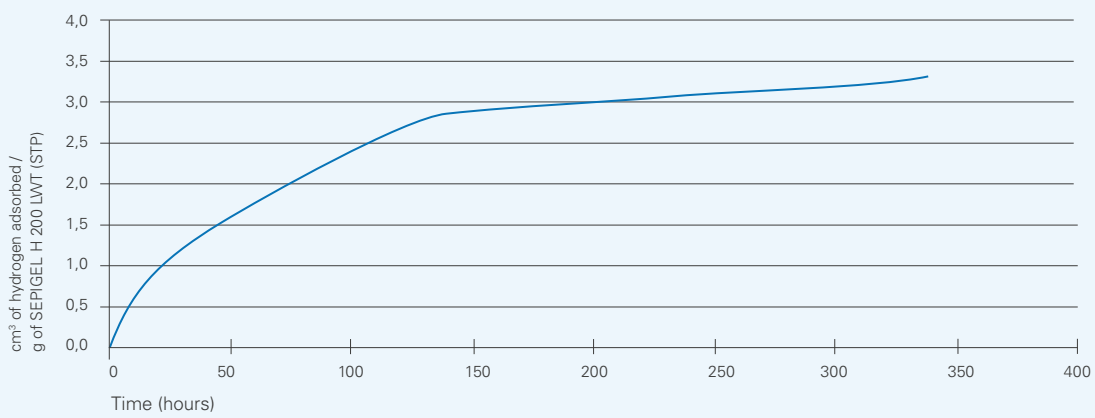
ADSORPTION OF HYDROGEN

Total hydrogen adsorption of 1 gram of **SEPIGEL H 200 LWT** is between 3.5 to 4 cm^3 in experimental conditions. Those are indicative values which can slightly differ according to experimental devices, amount of sample in the device and surface state of the sample. However they clearly show the high hydrogen adsorption capacity of the **SEPIGEL H 200 LWT**. It has an immediate capacity of adsorption of hydrogen to protect the fiber from the hydrogen generated during manufacturing.

CM³ OF VOLUME OF HYDROGEN ABSORBED PER GRAM OF SEPIGEL H 200 LWT



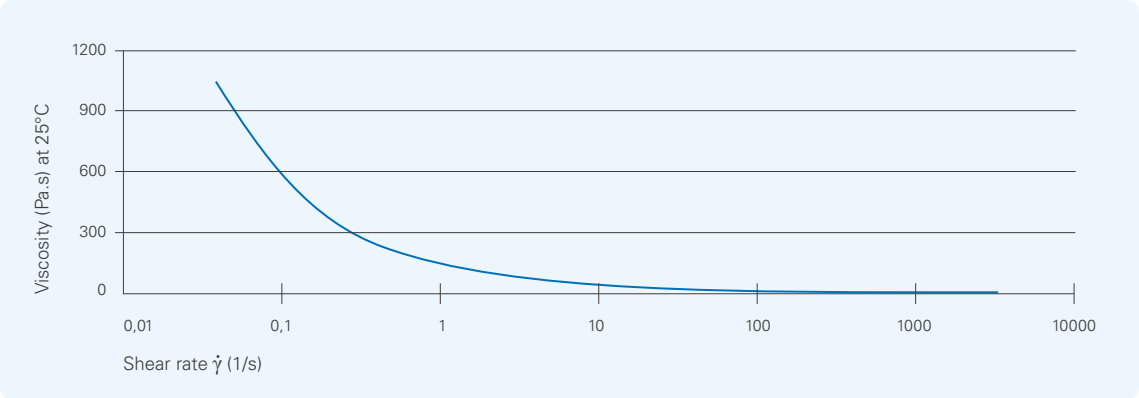
The filling gel **SEPIGEL H 200 LWT** also has a continuous capacity of hydrogen scavenging to protect the fiber during the cable's lifetime.



RHEOLOGICAL PROPERTIES

The **SEPIGEL H 200 LWT** is a thixotropic gel. It's plastic viscosity is given as the slope of the following curve of controlled shear stress (τ) versus measured shear rate (γ). The **SEPIGEL H 200 LWT** has a high plastic viscosity gel with values between 1.5 – 3.0 Pa.s.

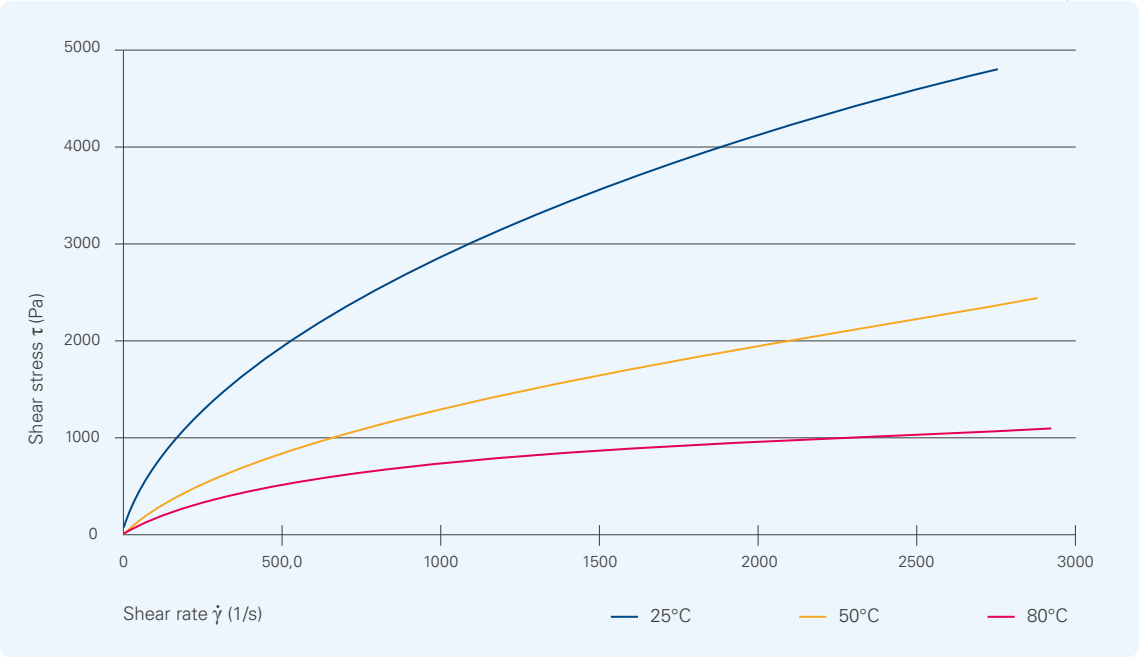
PLASTIC VISCOSITY vs SHEAR RATE



At high shear rate, when stress applied to the gel, it is fluid. Therefore the **SEPIGEL H 200 LWT** is easy to pump during the manufacturing of the cable.
SEPIGEL H 200 LWT is viscous at rest to provide mechanical protection to the optical fiber but still allow a bit of movement.

SHEAR STRESS vs SHEAR RATE AT DIFFERENT TEMPERATURES

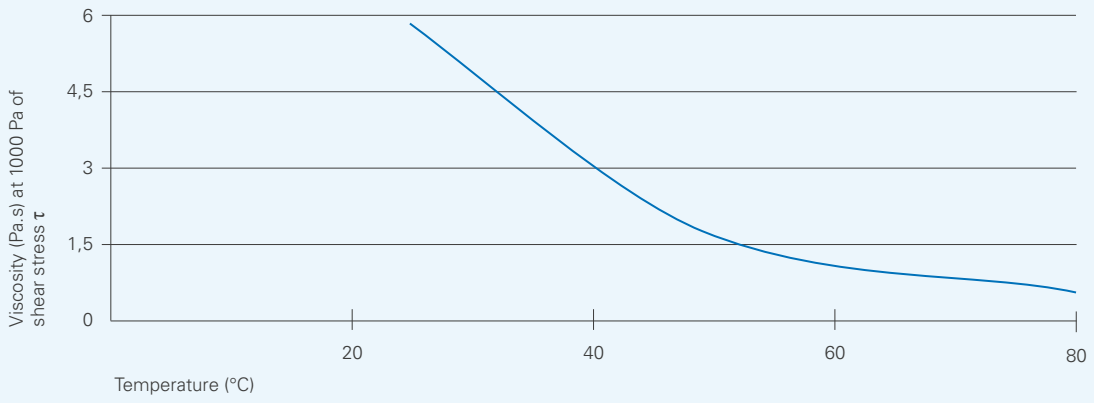
Even at 80°C the **SEPIGEL H 200 LWT** is viscous at rest (low shear rate); hence, the fiber is mechanically protected even at this temperature.



VISCOSITY DEPENDING ON TEMPERATURE

The viscosity of the **SEPIGEL H 200 LWT** decreases as the temperature rises.

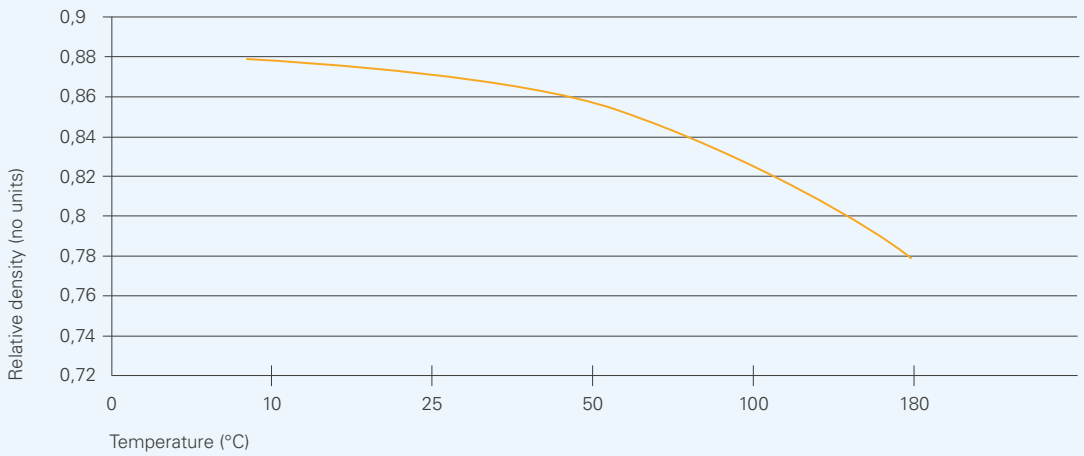
VISCOSITY vs TEMPERATURE



RELATIVE DENSITY

The relative density or specific gravity is measured with a picnometer on a 50 ml filling compound sample. It decreases as temperature rises.

RELATIVE DENSITY vs TEMPERATURE



Packaging and labeling

To keep SEPIGEL™ H 200 LWT in optimal conditions, drums must be kept tightly closed when they are not used.

SEPIGEL H 200 LWT is not a hazardous material, it does not contain Substances of Very High Concern (SVHC) and it is not corrosive.

It is packed in epoxy coated smooth sided steel drums, palletized and shrink wrapped:
Internal diameter: 570 mm
Net weight: 160 Kg

Drums are marked as follows:

- Name and address of supplier
- Product's reference
- Net weight in kilograms
- Batch number
- Legal labeling

For any additional information, please contact our technical department:
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Notes

Nota :

The analytical specifications warranted are only those mentioned on the certificate of analysis supplied with each delivery of the product.
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