Shell Sulphur Solutions

SHELL THIOCRETE

Technologies for sulphur-enhanced concrete

PRODUCT DATA SHEET

Shell Thiocrete is an innovative modified sulphur binder that completely replaces the cement and water in concrete. It is available in a range of formulations, tailored to the specific needs of different concrete applications, enabling precast manufacturers to produce high strength, durable products with a lower environmental footprint than conventional cement.

Concrete products are made with Shell Thiocrete using a hot mix process, similar to that used to manufacture asphalt for pavement construction. Shell has demonstration facilities to show prospective customers how this production process works and will provide the necessary technical support to assist precast manufacturers in making a successful transition from trials to full commercial production of Shell Thiocrete-based products.

Benefits of manufacturing precast products with Shell Thiocrete

- High mechanical strength
- Better utilisation of moulds
- No long curing period
- Acid resistant
- Low leaching – extending the range of aggregates suitable for concrete manufacture
- Freeze-thaw resistant (CDF method)
- Lower embodied CO_2[1]
- Reduced need for admixtures
- Colour retention and efflorescence free.

1. Compared to Portland Cement Concrete

Application

Due to the melting point of sulphur (~120°C), Shell Thiocrete should only be used in non structural applications. This encompasses a wide range of concrete products and Shell is willing to support precast manufacturers in exploiting the potential of this new technology where they see most value.

Shell opened a prototyping facility in 2010 where manufacturers can bring their moulds to experiment with Shell Thiocrete, or see a wide range of products already made. Currently there are two precast manufacturers, one in the Netherlands and one in Poland, making prototypes of paving flags, umbrella stands and railway products with Shell Thiocrete. Test marketing of the first Shell Thiocrete products began in Europe in late 2009.

Appearance

Shell Thiocrete can be delivered to customers in two forms, depending on customer preference and supply logistics.

- As a hot, orange liquid (~120°C) to be used on site directly or stored in heated tanks
- As a solid pellet, stored at ambient temperature and then melted when used.

Mixing equipment installed at Shell Thiocrete prototyping facility, near Amsterdam.

Umbrella stands made from Shell Thiocrete.

Production with Shell Thiocrete

Making precast products with Shell Thiocrete is based on combining established asphalt mixing technology and precast moulding techniques. Since concrete products made with Shell Thiocrete achieve their final strength on cooling, without the need for curing, it can deliver significant production efficiencies compared to conventional concrete products. Particularly for applications where the product would usually spend a significant amount of time in the mould.

Shell's technical specialists are available to support precast manufacturers throughout the process of becoming a successful Shell Thiocrete precast manufacturer with:

- The design of the production line including Shell Thiocrete storage options
- Choosing the right Shell Thiocrete formulation to match the needs of the end application
- Tailoring the mix design to make best use of available aggregate sources, including exploring the potential of using low value aggregates (not normally suitable for concrete production). This is enabled by Shell Thiocrete's high tolerance of aggregate quality.

Figure 1: Indicative material properties of concrete/mortar made with Shell Thiocrete

Description	Technical Info
Compressive strength	40 – 60 MPa
Flexural strength	10 – 17 MPa (3 point bending test)
E Modulus	35 – 40 GPa (measured in compressive mode)
Porosity	< 0.2%
Water absorption	< 0.1% (14 days total immersion)
Creep strain	0.13% after one year at 20°C - (Shell Thiocrete bound concrete)
Expansion coefficient	Estimated range 8 x 10^{-6} to 10 x 10^{-6} per °C (Shell Thiocrete bound concrete)

All values are for use of Shell Thiocrete as a mortar unless otherwise specified.

Recycling

Trials to confirm the commercial recycling processes for Shell Thiocrete are currently underway. Shell's development work to date indicates that Shell Thiocrete will be suitable for recycling in three ways:

- By crushing, reheating and reforming – to produce new concrete products with Shell Thiocrete as the binder
- By crushing and grading – to produce aggregate that can be used to make cement-bound precast products
- By crushing and grading – to produce aggregates that can be used as bound or unbound road base materials.

Aggregate from recycled Shell Thiocrete products.

Health and safety

As a hot mix process, handling Shell Thiocrete poses different risks to conventional concrete production and these need to be managed appropriately. To help customers safely make the transition from conventional to Shell Thiocrete concrete production, Shell offers tailored, on-site training support on all aspects of health, safety and environment. This includes:

- Recommendations on personal protection equipment
- Advice on engineering design and processes to manage the risk of volatile emissions
- Recommendations on ventilation requirements and dust control.

For further information

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