



SAVING TIME & MONEY

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SHOWS HOW TIME SAVINGS CAN
BE MADE THROUGH THE USE OF
STATE-OF-THE-ART REFRACTORY
PRODUCTS.**

Introduction

Commercial pressures in the cement industry increase all of the time and cost cutting measures pile up. All involved give thought as to how further cost savings may be achieved. Significant extensions to refractory life can be achieved by the introduction of new material concepts such as, for instance, the use of ZSI material and the Supergun spraying technique.

Refko sees further savings potential in the reduction of lost operating time by the use of modern materials and installation methods. This includes altered installation methods, such as single layer wall design and systems capable of rapid heating, e.g. SOL-GEL NANO bonded products and pre-shaped block products. These systems are described below.

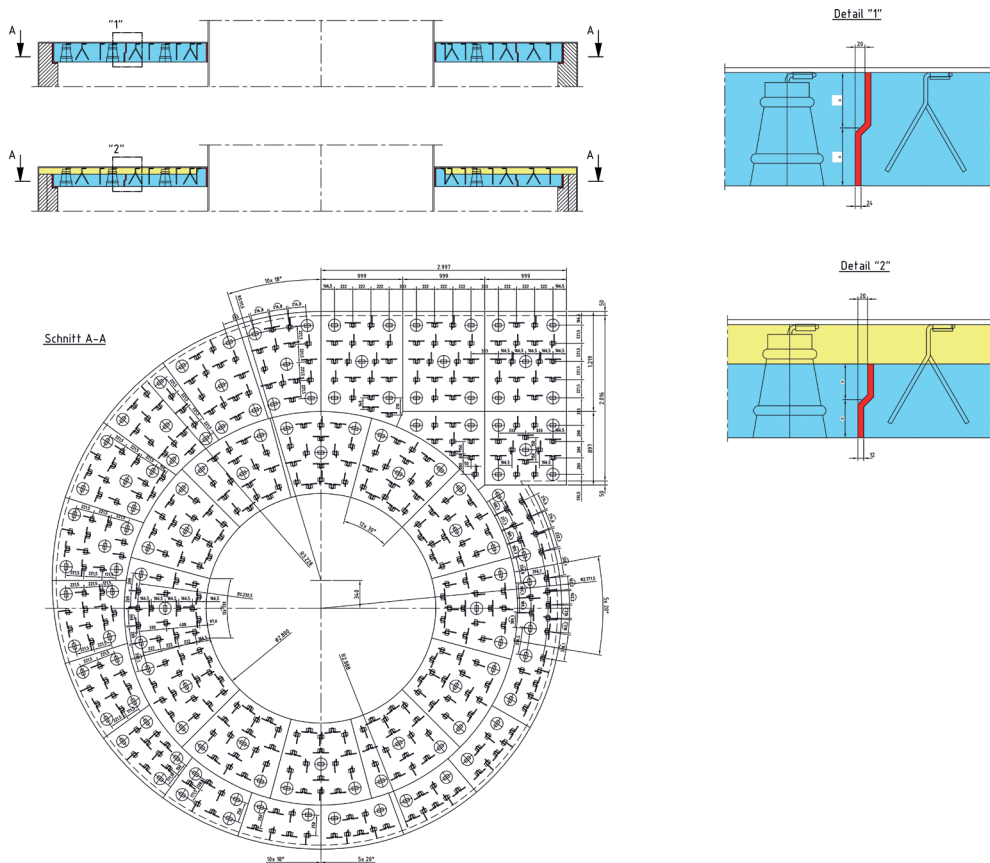


Figure 1. A classical cyclone roof compared with a single layered cyclone roof.

Installation using a single layer wall design

With the introduction of the Refko Supergun (LC-gunning concrete) and the Refko CastGun (LC-shotcrete), the time-consuming casting of concrete in many areas of the plant is no longer necessary.

Using this high-value gunning technology, installation times can be significantly reduced.

Also, with this method of gunning the classical wall construction of an insulation layer and one of dense

refractories was used until now. It is in this area that semi-insulating gunning concrete is finding its place.

If the wall construction can possibly be made in a single layer, there is a further, considerable saving in the installation time. The demanding changes of material and the necessary washing and cleaning of utensils and machines are avoided, as well as (possibly) the waiting time for an insulating material to set. The expensive cleaning of concrete remains from the anchors and the side shuttering is avoided completely.

As an example, it is possible to achieve 30% – 40% time saving in the installation of the cyclone roof in Figure 1.

All of the aforementioned advantages can be achieved by the use of the semi insulating gunning mix in the Supergun I series.

These concretes distinguish themselves through their low bulk density and their concomitant insulating properties. They demonstrate an adequately high strength and abrasion resistance.

Alkali resistance is also achieved by means of an optimised ceramic matrix design.

For example, in the lower steps of the cyclone (roof and side walls), these products are finding success and have

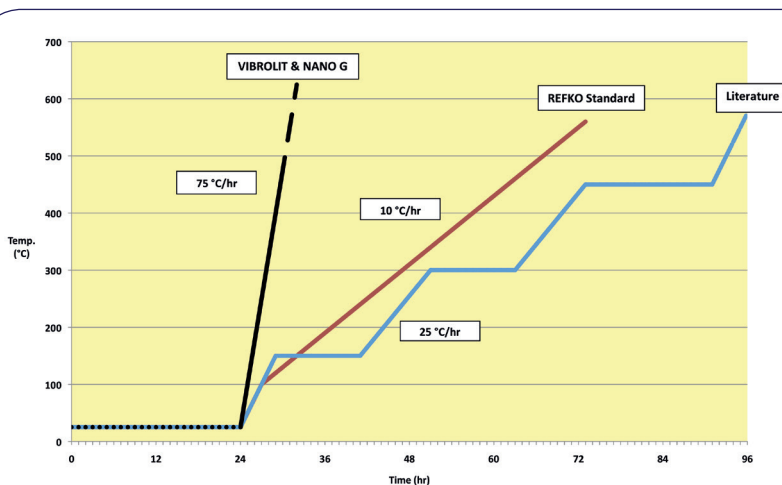


Figure 2. Heating curves.

displayed the aforementioned characteristics in terms of savings potential in their use.

Fast heating monolithics

An enormous time saving during shutdowns can be found when it is possible to reduce the heating times significantly. In spite of their increased service life, the massive use of monolithics leads also to the need to follow a closely controlled heating procedure when using the materials available until now. Due to the content of alumina cement in traditional monolithics, hydrates are formed in the product. These release water during the heating process. If the temperature gradient during the dewatering period (from 350°C) is too high, a steam explosion may occur that could wreck the whole refractory installation. In order to hinder this so called spalling, the kiln must be brought up to temperature relatively slowly.

In Figure 2, heating curves from technical literature are compared with Refko standard curves and those of VIBROLIT and NANO-G. In order to achieve working temperatures safely, it was customary and necessary to heat at between 10°C and 25°C/hr. The potential for faster heating of VIBROLIT and NANO-G is seen clearly in Figure 2. The products based on SOL-GEL Nanotechnology can safely be heated at rates of up to 75°C/hr.

Using this technology, the heating phase and consequently the whole shutdown can be shortened by up to four days. This means that the refractory brickwork and the mechanical conditions (e.g. the expansion of the rotary kiln in the tyre portions) control the rate of heating rather than the monolithics.

As opposed to hydraulic bonding, the SOL-GEL formation is based upon the development of Si-O-Si bonds formed of a colloidal NANO-SiO₂ solution with a very limited amount of physically bonded water. Generally, this physically bonded water is less problematic in drying out than the chemically bonded hydrate water in traditional refractory mixes and can, due to a considerably more permeable pore structure, very easily dry out from the concrete.

Refko has its own experimental kilns, built especially for

product development, in which the characteristics of the new products can be simulated very well. Blocks of the following dimensions were produced so as to conform to the sizes to be used, in practice, in the installation areas:

- 500 x 500 mm area.
- 150 mm insulation, 250 mm dense concrete.

24 hours after casting the blocks, they were built into the kiln and heat was applied to one side. Figure 3 shows



Figure 3. Destroyed LCC (left side) and undamaged VIBROLIT SOL-GEL test block (right side).

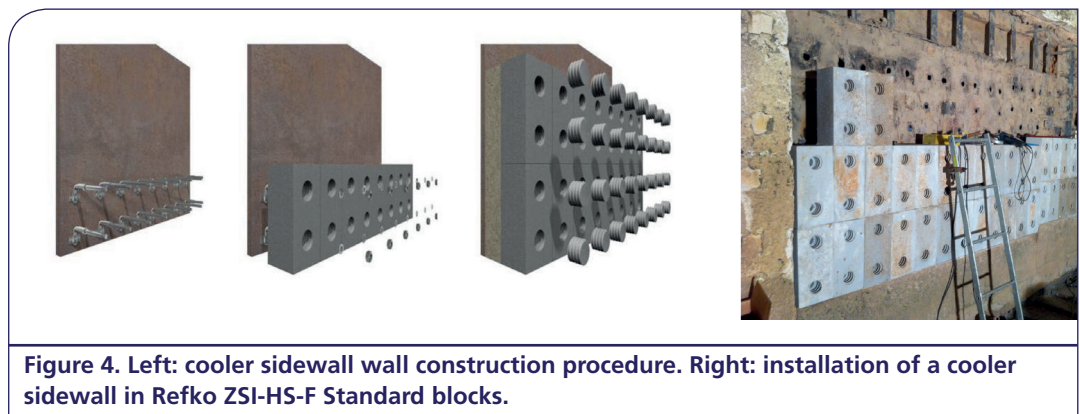


Figure 4. Left: cooler sidewall wall construction procedure. Right: installation of a cooler sidewall in Refko ZSI-HS-F Standard blocks.

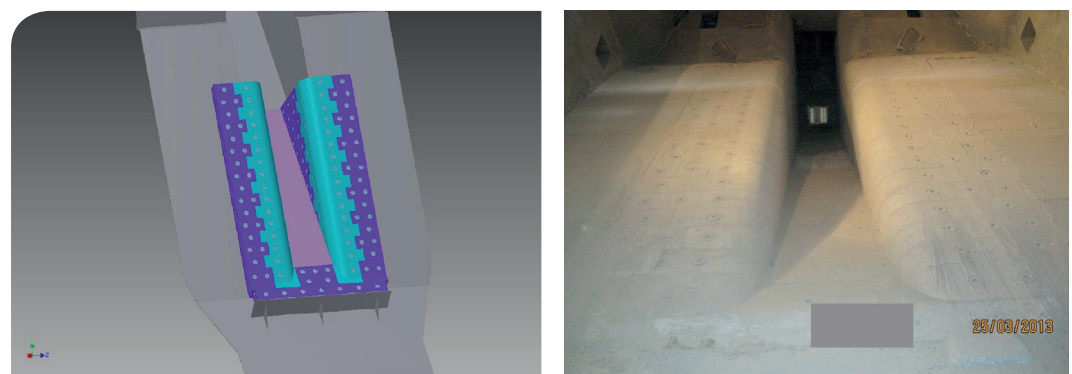


Figure 5. Left: drawing of a tyre chute. Right: completed tyre chute.

a traditional LCC concrete after having heat applied at 75°C/hr. The explosion occurred at approximately 400°C.

As a comparison, a block of VIBROLIT, after the same heat treatment, is also shown in Figure 3. The differences speak for themselves.

Based on these test results, increasing numbers of installations were carried out with VIBROLIT (casting version) and NANO-G (gunning version). The main places of installation were the zones that traditionally suffer from heating difficulties, such as the cooler, the bull nose, the kiln hood and the burner lance.

In addition to the increased rates of heating, the SOL-GEL nanotechnology-based monolithics showed further positive characteristics, including:

- Even better chemical resistance.
- Decreased formation of buildup.
- Increased temperature resistance.
- Furthermore the VIBROLIT / NANO-G (SOL-GEL Nanotechnology) products demonstrated a distinctly greater storage life than otherwise comparable LCC products. VIBROLIT/NANO-G (SOL-GEL Nanotechnology) products exhibit a storage life of not less than 12 months.

For the winter season 2015/2016, Refko will introduce a frost-resistant binder version to the market: Refko BOND SOL FS (Freeze Save).

Precast shapes suitable for rapid heating

In areas under extreme mechanical, chemical and thermo-mechanical attack, recent years have seen the use of ever more pre-shaped refractory materials. This has

achieved a reduction in shutdown time thanks to faster refractory installation time, faster heating possibility and the improved service life of the refractory installations.

As a result of the controlled production conditions at the refractory producer, these ready-finished shapes usually exhibit better characteristics than the equivalent refractory concrete, which would be cast on site. Refko RR and RRZ preformed shape systems are fired above 1200°C. As a result, in an installation, they can be subjected to heating in a similar manner to refractory bricks. Time consuming drying and heating curves, which are necessary for freshly cast, concreted areas, may be dispensed with. In addition, the installation of these pre-fired shapes usually proceeds more quickly than construction with concrete.

The following guidelines are adhered to in the design of Refko's pre-shaped materials:

- Simple installation from kiln interior outwards.
- No damage to the existing sheet steel structure, e.g. by the drilling of holes.
- The possibility to exchange individual shapes.
- No casting in of any anchors inside the pre-shaped block. This means that the component can be used again, even in the case of a premature failure of the metallic anchorage. Just the metal anchors have to be replaced; the expensive refractory shapes can be reused.
- Fabricated under optimum conditions in Refko's plant. The mixing of the materials, the temperatures, the casting operations, the setting conditions and the heating process are managed in optimum conditions.