



## Extend the service life of your kiln with veneering.

### Hot spot in the lining and general overhaul is still three months away?

Time is money. This applies to every manufacturing industry. The production of cement clinker and lime is a complex system with many pitfalls where the three main components must be brought into harmony: the kiln system, the raw meal and the refractory material. Any small disturbance of one component can have a major impact on the whole system. If the kiln does not run smoothly, the risk of the refractory material being damaged in a short time increases. If the composition of the raw meal is varying, not only an inaccurate clinker or lime is produced but also the refractory lining can be damaged. Once the refractory material is affected, it loses its protective effect and the kiln shell can overheat and become deformed. High consequential costs arise. Costs for refractory material only make up a minor part of the operating costs, but they form the basis for a running kiln and thus for a properly used production capacity.

It is even more frustrating when a refractory damage occurs only shortly before the planned overhaul. Bringing forward the planned stop is only possible in rare cases due to unprepared logistics. The fuel tanks have not been run empty and neither refractory material nor installation personnel are on site. In this situation, a fast repair for a short bridging to the planned shutdown of the kiln is needed. Refratechnik Cement offers a cold repair technique that allows to fix refractory damages fast and easy: The veneering technology.

Thermochemically resistant as well as flexible refractory concretes are applied to the worn lining in a fast gunning process that allows a quick restart of the kiln. Short downtimes and a less complex installation keep the costs low compared to the installation of new monolithic products or classic new brick laying instead.

### What are the possibilities of veneering?

There are various possible applications of veneering. The repair of small hot spots is as possible as the repair of the complete lining in full circumference (Figure 1/2). Lost bricks can be replaced entirely, or, in case of insufficient lining thickness after brick spalling phenomena, veneering concrete can be installed on top. This can be useful if the kiln comes down prematurely a few weeks before the scheduled overhaul. The time remaining to the planned shutdown and the size of area to be repaired play a key role in deciding whether veneering is suitable. The plant operator can decide between a more durable, but initially also more time-consuming expensive brick laying repair or a faster and cheaper veneering solution.



**Figure 1/2:** Insights into practice: Veneering of a hot spot (Fig. 1) and a protective layer in full circumference (Fig. 2), both kilns with a diameter > 5.00 m.

Besides emergency repair veneering also offers other areas of application (Figure 3). The use of a protective layer when the rotary kiln is restarted, so-called „heat-up protection“, established itself as a suitable solution. Lining that has already seen a campaign or a certain period of production is often infiltrated with various salts and has lost its flexibility, making it particularly susceptible to thermo-mechanical loads. In this case, the application of a heat-up protection reduces the thermal gradient and allows a smoother temperature rise in the lining until a protective coating has formed. Brick head spalling can thus be reduced, especially during the critical heating up phase.

Veneering can also be used to easily adjust the height compensation between an old and

new lining and prevents abrasion or blockages caused by the raw meal passing through. Specially shaped bricks, conical parts of the rotary kiln for example, can also benefit from veneering, as their production is often associated with long delivery times. A timely gunning of veneering can significantly extend their life span and reduce warehouse costs to store these special shapes for a long period.

#### How is veneering used?

Veneering is a fast method of gaining lining thickness in a worn section to reach the upcoming overhaul. The installation of veneering is possible using the casting, wet gunning, or dry gunning process. However, primarily the dry gunning method develops its full effect regarding easy handling and short processing time. The equipment for

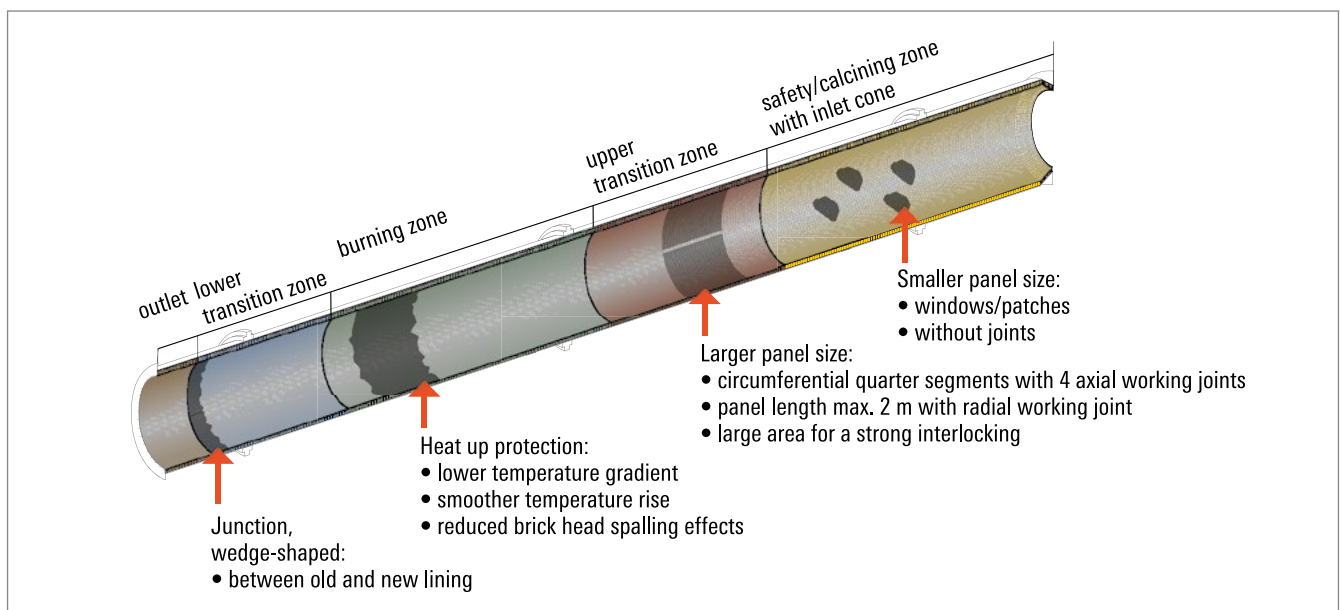
dry gunning is available in many plants and allows the veneering concrete to be transported over long distances to all static areas and in the rotary kiln.

Aluminosilicate concretes of the system  $Al_2O_3-SiO_2$  e.g. REFRA-MULLITE 60 EDG Z AR are used in the static areas and the calcining zone of the rotary kiln. For a non-basic veneering lining an average service life of 12 months in the calcining zone was realized.

In the areas of the rotary kiln that are subject to increased thermal and thermochemical stress, basic concretes with a thermal expansion coefficient very similar to that of basic bricks are recommended, e.g. REFRA-MgO 90 SG or REFRA-MgO 82 SG. Dozens of plants have successfully installed basic veneering concretes. The installation mainly took place between upper and lower transition zone where we met the individual targets regarding life time from several weeks up to months.

#### Does the coating have to be removed?

Depending on the kiln area where a repair is necessary, the removal of the coating is always a key question in terms of safety and the duration of the downtime. The more coating to be removed, the longer the kiln downtime. What does this mean for the veneering process? All areas of the kiln that are accessed by the installation personnel must be safe: either the coating has to be removed or common appropriate safety precautions, such as a protective cage, tunnel or scaffolding, must be taken. The lining itself, to which the veneering concrete is to be applied, must



**Figure 3:** Examples of veneering linings in the rotary kiln for cement clinker production



always be free of coating. New as well as old veneering layers have to be treated like coating in terms of safety, the same protective measures must be taken.

Before the veneering installation starts the residual thickness of the bricks must be determined. The veneering thickness is usually 30 to 120 mm, up to this thickness no additional anchoring is necessary in most cases. Formwork is not required. Before installation, the area must be cleaned using suitable methods (sweeping, vacuuming, blowing off, etc.). Smooth refractory surfaces can be roughened by sandblasting. Dust, loose clinker, loose adhesions and brick heads as well as layer-like spalling material must be removed to achieve the best possible surface. For veneered linings no specific drying and heat-up are necessary. The kiln can be put back into operation in line with the standard heating up procedure. The exact installation instructions have to be discussed in each case individually and depend on the refractory concrete used, the installation method, the type of damage, and the surface of the lining. Appropriate processing guidelines have been drawn up by Refratechnik Cement in close cooperation with international customers and installation companies considering work and installation safety as well as the best possible interlocking between the existing worn lining and the gunned veneering material.

A veneering lining in static areas of a cement plant is usually more durable and less demanding. In dynamic areas of the rotary kiln, however, numerous factors influence the adhesion and thus the durability. The gunning process of the veneering material onto a worn, rough surface does not initially present a significant challenge. Nevertheless, it is important to achieve a very good form closure and bonding strength between the old refractory lining and the veneered refractory concrete in all parts of the rotary kiln. Wear factors of the old lining different for each zone play a significant role for the quality of adhesion (Figure 4). Besides an insufficiently cleaned surface and loose layers, especially high alkali chloride, alkali carbonate and alkali sulfate/sulfide salt loads in the area of the worn surface can have an impact on the interlocking.

Refratechnik Cement's veneering concretes are specially designed and developed to meet these requirements. They are characterized by a safe gunning behavior, rapid hardening even at low processing temperatures, high adhesion without anchoring and a very good interlocking with the worn surface. In most cases, these well-balanced settings and properties contribute to optimized application behavior and thus also support the cement plant operator in extending the service life of the refractory lining until the planned shutdown.

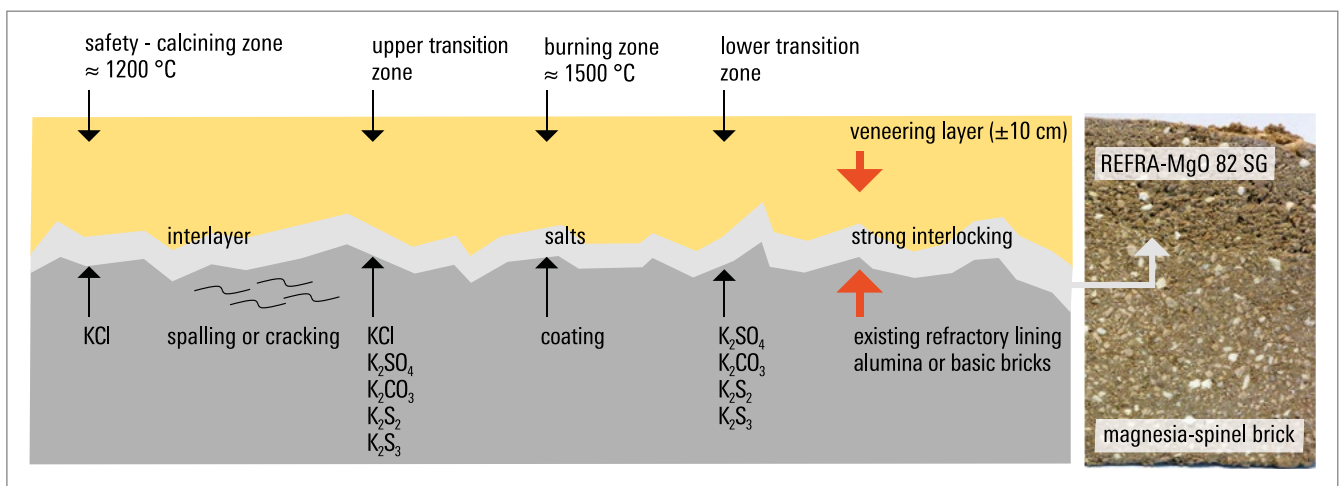
### Your Challenge – Our Solution

Especially due to the quick installation, veneering enables a quick return to production and thus low production losses. Although veneering is not a substitute for new brick laying, it is a small, inexpensive, and, above all, effective repair measure that can reduce follow-up costs when used in a targeted manner. This is our answer to unplanned kiln stops. To ensure the full benefit of the veneering concept strategic stocks at our production unit and strategic warehouses are already established. Furthermore, we are working on optimizing the refractory linings in all areas of the plant, for example, by preparing basic refractory concretes especially for use in static areas in order to withstand the increasing thermal and thermochemical loads and to reduce alkali-based wear.

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**Figure 4:** From the safety zone to the lower transition zone: Illustration of the contact/worn surface area between an existing refractory lining and the gunned veneering layer. Wear factors different for each kiln zone can have an impact on the interlocking.