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Micro-tears and grey discolourations in concrete products

Concrete blocks are a fundamental element for the design of spaces in many areas of life, both in the private and public sector. The constant further development and diversification of concrete blocks with regard to new formats and surfaces results in changed requirements for their production. The following article focuses on two aspects in concrete block manufacturing that can negatively affect the product quality. It concerns the causes for so-called tampershoe adhesions on concrete block moulds at the moment of demoulding during the manufacturing process as well as the formation of bloom in particular with white cement products. In close cooperation with its international customers, Kobra Formen GmbH concerns itself with the continuous further development of its concrete block moulds and has developed ways of avoiding these manufacturing problems from the point of view of the mould manufacturer.

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Tamper shoe adhesions on concrete block moulds during the manufacturing process

Concrete block products with strongly structured or natural stone-like surfaces, 'mixed layouts' that are complicated to manufacture and large-size slabs require the use of high-quality aggregates, a concrete recipe adapted to the product and a suitable mixture in preparation for the manufacturing process. The quality of the concrete blocks may be reduced if one or more of the points mentioned are impaired.

Measures for quality assurance before the manufacturing process

Quality of the aggregates

If too high a content of slurry-forming components - i.e. materials with a grain size less than 0.063 mm - is used in the concrete mixture, laminar material breakouts can occur at the surface of the block. Slurry-forming components are amongst others clayey materials, loamy sands or crushed sand. These can adhere to the aggregates or may be present in the concrete mixture in powder form.

In an excessively high concentration they increase the water demand and can adhere so fast to the grain surface that they are not rubbed off during mixing and thus impair the connection between aggregate grain and cement stone. Conversely, if they are present in low quantities, they can exert a positive effect on the workability of the fresh concrete and improve the impermeability of the concrete.

Storage and preparation of the aggregates

If the aggregates are stored under detrimental conditions, there is a danger of segregation of the granulometric composition and thus of unforeseen grading curve fluctuations.

In principle the term 'grading curve' designates the graphic illustration of the grain mixture of the respective aggregates after they have been separated into the individual granulometric fractions using sieves with different mesh sizes. The objective is to determine the proportions of certain grain diameters in the aggregates and to match them to one another in order to determine the ideal grading curve for the respective product.

In the case of the segregation of the aggregates mentioned above, the impermeability of the concrete microstructure can be weakened, since the hollow spaces between coarse grains can no longer be completely filled by smaller grain sizes.

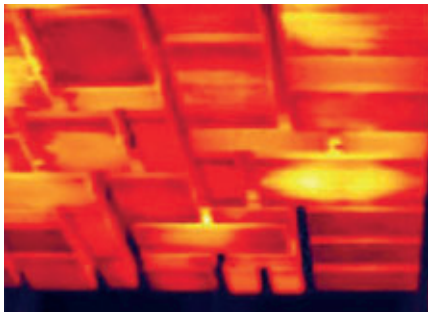
This tendency can be counteracted and a favourable grading curve can be retained by the use of special round aggregates silos and a constant aggregate fill level.

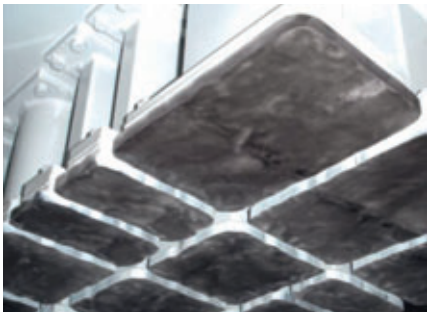
Concrete recipe

Too high a water-cement ratio (w/c ratio), in particular with very fine concrete mixtures, can lead to material adhesions in the chamfer and edge region of the concrete block products because, although it facilitates the processing of the concrete, the final strength may be reduced.

It must be remembered that 100 % of the weight of the cement is not bound to water as it hardens. In addition, water forms capillaries in the concrete product when drying.

A smaller w/c ratio therefore leads to improved strength and impermeability of the final product, but is rather less suitable





Hotshoe™ technology from Kobra Formen GmbH

for the manufacture of blocks with filigree surfaces since the individual structures cannot be reproduced in such good detail. The employment of the HotshoeTM technology from Kobra Formen GmbH is useful in this case. This is described in greater detail below in 'Measures for quality assurance during the manufacturing process'.

Mixture preparation

Irregular craters and pimples on the block surfaces can also occur due to unfavourable mixing sequences with regard to the order and time of the addition of individual components as well as the duration of the respective mixing sub-steps.
This problem can be counteracted by the intensive mixing of all solid components before the addition of the water.

Measures for quality assurance during the manufacturing process

All the points mentioned must be observed in preparation for the production process of concrete block products. From the point of view of the mould manufacturer it is the compaction process that is most important during the manufacturing, since the mould is directly involved here as a tool for the manufacturing of concrete blocks.

Hardened tampershoes in concrete block moulds

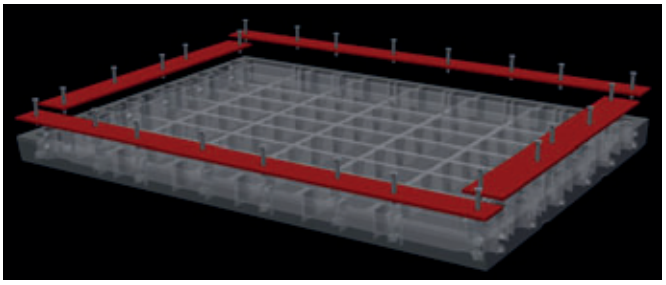
For basic quality assurance and the avoidance of tamper shoe adhesions, Kobra recommends the in-house hardening standards Optimill carbo™ and Optimill carbo 68 plus™, which are characterised by completely milled mould inserts and tampershoes. These result in smooth, accurate and straight surfaces for simplified demoulding and high-quality concrete products.

Coating of tamper shoes in concrete block moulds

In order to obtain optimum results at the moment of demoulding, the tamper shoes of concrete block moulds can also be given special coatings. These include Teflon, PACVD (Plasma Assisted Chemical Vapour Deposition), HVOF coatings (High Velocity Oxygen Fuel) and the chromium plating of surfaces.

Hotshoe™ technology from Kobra Formen GmbH

The Hotshoe technology was developed in order to achieve higher surface qualities of the concrete blocks. Through the use of heated tampershoes on the tamper head, controlled lifting of concrete takes place. Thus adhesions of moist, fine facing concretes can be prevented at the moment of demoulding. The temperature ranges are thereby freely controllable for the specific product and customer. Many years of practical experience show that the best results are achieved at process temperatures between 50 °C and 70 °C at the tampershoe surface.
The technology has been constantly developed and today encompasses a complete equipment package including control technology. The basic technical outfit is completed with a once-only installation of the main connecting cable, the control and regulating equipment and the cable to the machine's tamper head. Each mould is thus controllable. Hotshoe™ moulds are manufactured for the specific product according to the tampershoe to be heated and the ΔT values to be achieved. Temperature sensors located directly at the surface ensure reliable reheating to the target temperature in each production cycle.
Facemixes with higher powder and fines contents and high cement contents are simpler to process. Moreover, heated tampershoes pro-



Cover plates and tampershoes in Optimill carbo 68 plus™ quality

duce smoother surfaces with a brilliant sheen. Rough micro-tears, as produced by cold tampershoes, disappear.
Combination with further Kobra technologies, such as the proven Flexshoe™ feature, is easily possible.

Bloom with white cement products

Discolourations of concrete products can be attributed to different factors. These include external influences, i.e. different types of weathering and seasonally related causes, the intensity of use or also the installation of the concrete blocks. The use of the aggregates and binders also plays a significant role; their quality characteristics and proper use have already been dealt with in this article.
Furthermore, possible metal abrasion during the production phase should be mentioned as a cause of discolourations. In this case contact occurs between the concrete mixture and metallic components of the concrete block making machine or the concrete block mould in the individual components that follow one another in the manufacturing process - concrete mixer, concrete transporter, storage container, concrete feeder and brushes on the concrete feeder and finally the concrete block mould. The abrasion of very fine metal particles leads to discolourations.
An important countermeasure is to improve the hardness properties of the individual components.

Hardening technologies for the concrete block mould

Depending on the method of construction of the respective concrete block mould, Kobra Formen GmbH has developed different hardening technologies that significantly decrease metal abrasion.
Optimill carbo 68 plus™ for all paving stone contours

- Hardness quality of at least 66 HRC [Rockwell] with a tolerance of +2 HRC and -0 HRC
- Depth of hardening of 1.2 mm

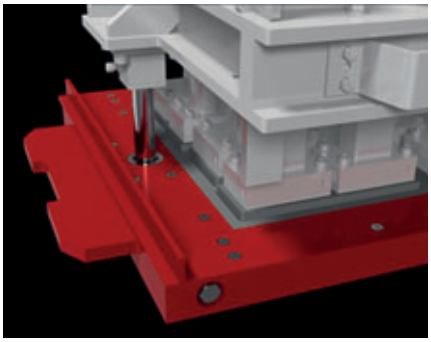
Optimill carbo™ for all block contours

- Hardness quality of at least 62 HRC [Rockwell] with a tolerance of +2 HRC and -0 HRC
- Depth of hardening of 1.2 mm

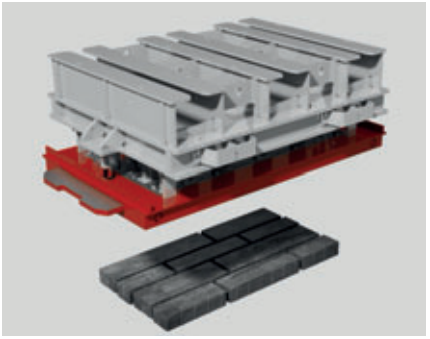
This includes not only improved hardness properties of the mould insert, but also of the tampershoes in the mould upper part as well as the cover plates in the mould bottom. The first moulds with both insert and cover plates in carbo 68 plusTM quality were delivered in 2014. They exhibit a considerably higher number of cycles without the necessity for premature replacement of wearing parts.

Headguide™ – mechanically forced guidance of the tamperhead

A further possibility to reduce metal abrasion and thus bloom on the concrete block is the mechanically forced guidance of the tamperhead to the mould bottom during compaction. The system protects particularly sensitive mini-chamfers on large-size slabs and ensures absolutely central installation of the complete mould into the machine. During the vibration the mould upper part is guided precisely without the tampershoes being able to touch the cavities of the insert. Bolts and bush are replaceable as wearing parts and are thus easy to repair.
Thanks to the modular construction of Kobra moulds, all technologies - hardness standards, coatings, Hotshoe, Flexshoe and Headguide - can be combined with one another, depending on the desired product. The sales employees and engineers from Kobra, as a reliable partner and supplier of innovative solutions for product improvement, are at your service for all the above-mentioned challenges in the manufacture of concrete blocks. Kobra moulds are available worldwide.



Headguide™ technology from Kobra Formen GmbH



Combination of tamper shoes and cover plates in carbo 68 plus™ quality, auxiliary coating of the tamper shoes and cavities, Hotshoe™, Headguide™ and Flexshoe™

FURTHER INFORMATION

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