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Solvay Barium Carbonate

Information on the prevention of efflorescence on bricks and tiles

What kind of defects do roof-tiles and clinker bricks suffer from?

High quality, discoloration-free bricks are now an established feature of today's market. For decades brickmakers have been working to reduce efflorescence on bricks; this often proves difficult in view of the varying sulphate and pyrite content in the raw materials used.

If you too should encounter any problems with surface impurities or efflorescence, we recommend that you contact the Technical Application Department at Solvay & CPC Barium Strontium GmbH & Co. KG. Our decades of experience will provide you with a better chance of finding a solution to suit your requirements. Thorough preliminary investigations to determine the sources and causes of such impurities will of course be necessary prior to providing advice.

The following come into the reckoning as possible sources:

- Efflorescence occurring during drying; this is caused by soluble sulphates in the clay, loam or aggregates (e.g. thinning agents) and by soluble substances in the mixing water (predominantly pit water).
- Sulphurous deposits formed during drying; caused by sulphur dioxide, respectively sulphur trioxide in the dry air when chamber drying.

Causes of Efflorescence

Efflorescence arising during the drying period is brought about by the diffusion of soluble salts which conglomerate on the surface of the blank while it is drying. It is an efflorescent process which is however already completed after the drying period.

Subsequent efflorescent phenomena occur by different means on the fired product. In such cases it is not possible to predict when the efflorescence will end. The fact that both processes (drying-related and subsequent efflorescence) are however collectively referred to as efflorescence can easily lead to misunderstandings.

Tests have shown that drying-related efflorescence mainly occurs during the first half of the drying period. The concentration of salt deposits on the surface of the blank is dependent, among other things, on the speed of the drying process and on the blank's water content. It has been observed that the efflorescence is more clearly perceptible after a slower drying process and occurs especially on the corners and edges of the blank. When the drying process is faster the efflorescence is spread more evenly over the whole blank and appears on the whole to be weaker. A surplus of water, on the other hand, has a negative effect since it promotes the movement of the dissolved components to the surface.

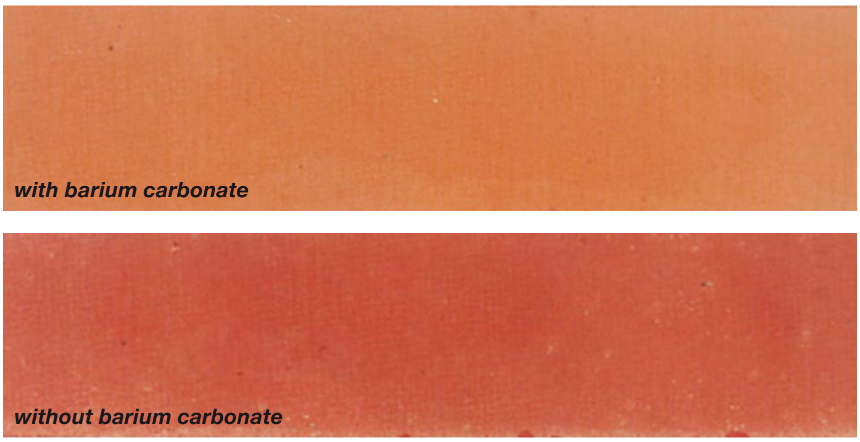

Illustration No. 1
Example of drying-related efflorescence on a brick. The fired outer wall bricks can either be of a uniformly red colour over the whole surface (above with the addition of barium carbonate) or covered over with white to greyish-yellow deposits (below without barium carbonate addition)

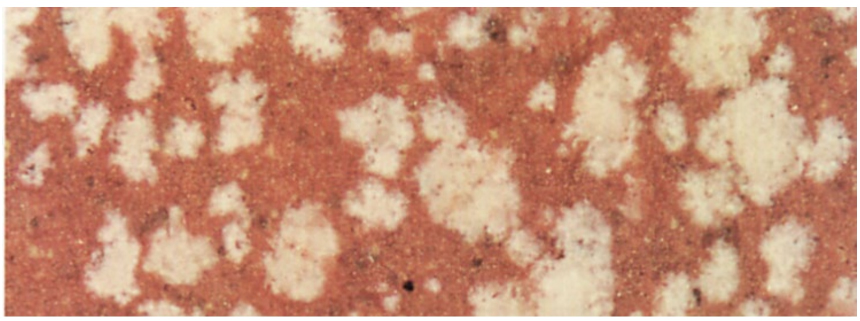

Illustration No. 2
Example of drying-related efflorescence on a brick – enlarged view. Under the microscope it becomes evident that a number of individual, almost white spots give the brick's surface an impure-looking, respectively discoloured overall appearance

Seen from the chemical standpoint, the drying-related efflorescence principally involves sulphates of sodium, potassium, calcium and magnesium. It is not until during the firing process that a chemical reaction takes place. Up to that point the sulphates hardly change; when the sintering process begins they then react with the blank's surface constituents. The corresponding silicates or alumo silicates then form and cannot subsequently be removed.

How does a sulphurous deposit form?

The sulphurous deposit forms due to the presence of sulphur dioxide, respectively sulphur trioxide (SO_2/SO_3) in the dry air. This phenomenon occurs when light oil is used for drying purposes in the brick/tile industry. The now outdated flue gas drying process used to lead to the formation of similar sulphurous deposits.

In most cases, the waste heat of the kiln is not sufficient to dry the blanks. Light oil offers an additional means of ensuring the effective drying of the blanks. It is used among other things for the direct heating up of the dry air. The burning mostly takes place in a highly oxidising atmosphere, i.e. with a high air surplus. The consequence of this is an increase in the proportion of sulphur trioxide in the heating gas. Due to the water content of the blank, the dry air becomes cooled and the critical dew point is reached. Certain constituents of the blank's surface react very easily with the sulphur trioxide.

This leads to the formation of a sulphurous deposit which is already identifiable on the surface of the blank on completion of the drying period. This deposit too becomes firmly burnt into the surface at higher temperatures.

Our experience justifies your trust

The technical application laboratories at Solvay & CPC Barium Strontium GmbH & Co. KG deal daily with the problems of brick and tile manufacture. The use of barium carbonate – a Solvay & CPC product – is very frequently the recommended solution for improving brick/tile quality. The wide range of possible sources of defects calls for a wealth of experience in order to be able to correctly assess each respective situation.

The specialists at Solvay & CPC Barium Strontium GmbH & Co. KG have this experience. Even where highly specific questions are concerned, everything possible will be undertaken to find the sources of defects in your raw material or production process.

We will gladly advise you – free of charge – in all problems, irrespective of whether these involve efflorescence arising during the drying process, surface deposits, discoloration or subsequent efflorescent phenomena.

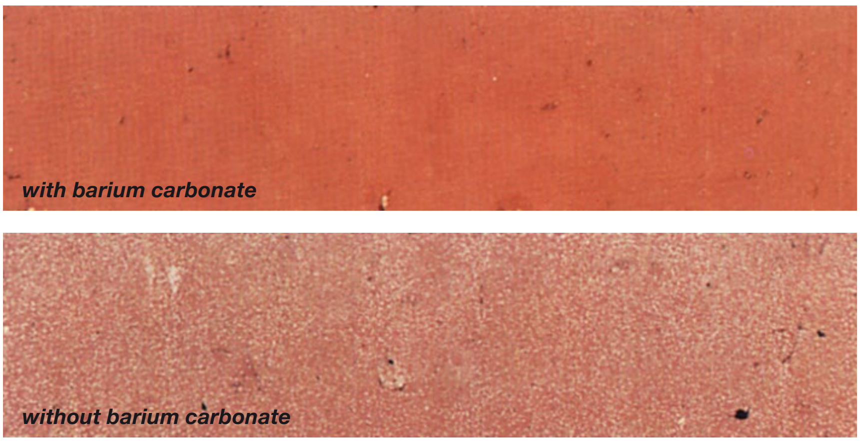

Illustration No. 3
Example of drying-related efflorescence on a brick. In this picture, the difference between the surface of a brick produced with barium carbonate addition (above) and one produced without barium carbonate addition (below) is more plainly visible than in figure 1

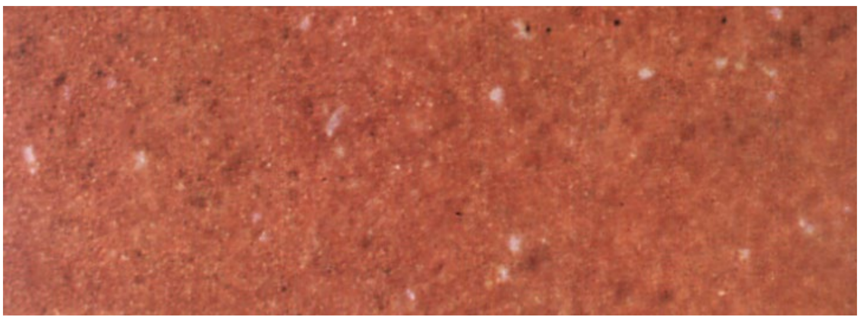

Illustration No. 4
Enlarged view showing a blank containing barium carbonate. Compared with figure 3, the microscope photo clearly shows the homogeneity of the blank with barium carbonate content. It can thus be concluded that no sulphates were carried to the surface during the drying process, i.e. that the salts are completely contained

Instructions for submitting clay and tile/brick samples

To enable us to carry out a chemical-physical analysis to determine the harmful constituents for you, please submit the following samples:

1. Raw material

- 1 kg of each of the types of clay used from the mine (where possible in a plastic bag labelled on the outside).
- One dried blank, where applicable dried in open-air, flue-gas or other artificial drying processes (appropriately labelled).
- 1 kg each of thinning agents or other ingredients packed in a plastic bag (labelled)
- One bottle of mixing water (if pit water is used).

2. Fired material

Bricks with each typical defect (efflorescence, surface deposits, discoloration, etc.) in weakly fired, normally fired and well-fired versions.

3. Efflorescence

If available, a sample taken from the wall or roof (approximately 3 g), in a well-sealed plastic bag.

Questions

To simplify the evaluation of the analysis results, please answer the following questions:

a) How does the defect appear?
Brief description of the appearance.

b) At which point and where is the defect first observed?
After completion of drying process – immediately after firing – when stacking – a short time after laying the brick or a long time after completion of the building? Where in the main?

c) Which drying process is used?
Flue gas – oil ancillary heating – direct or indirect – kiln waste heat – other heat sources?

d) Which fuel is used for firing?
Please give sulphur content if known.

e) How high is the firing temperature?

Please send these samples with corresponding list to:

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