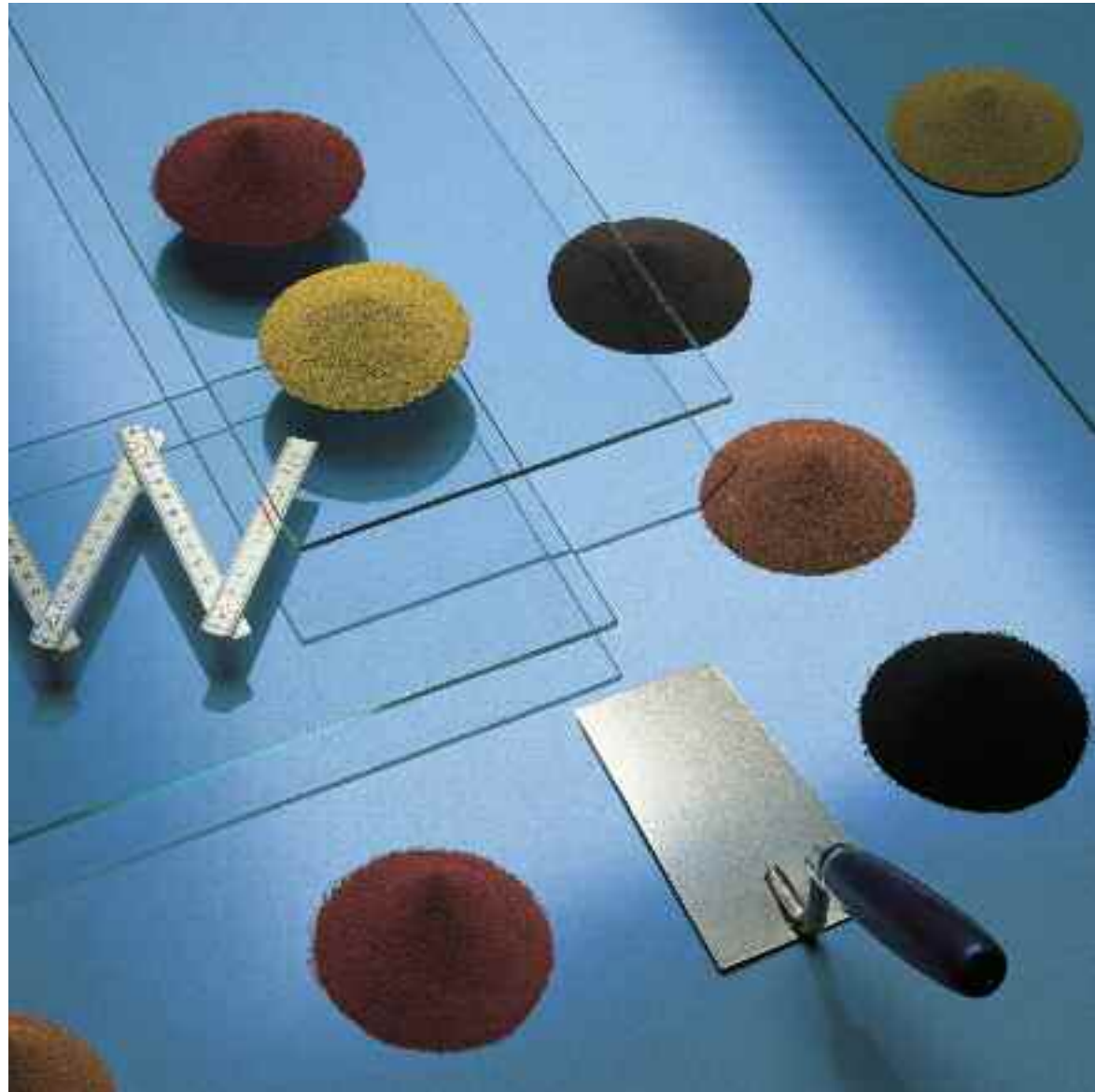


***Your Guide to Using Bayferrox® Pigments  
to Color Concrete Products***



LANXESS Corporation was formed when the Bayer Group combined most of its chemicals businesses with large segments of its polymers activities. The company began doing business as a new legal entity in the United States on July 1, 2004. LANXESS will continue manufacturing Bayferrox® iron oxide pigments, which is a registered trademark of Bayer AG, Germany.

The use of color in concrete building materials is increasing in popularity. Today, it is an important design tool for architects, builders, engineers and homeowners to express their style and individuality. Color is commonly used in products such as concrete roofing tiles, pavers, block, precast products, and segmental retaining wall units. These colored building materials are in high demand and are also more profitable to manufacturers than their uncolored counterparts.

As a result, manufacturers of concrete building materials are faced with the challenges of selecting and using pigments correctly in their production facility. At LANXESS Corporation, we understand these challenges and are here to assist you. That is why we have produced this detailed brochure. It is your guide to understanding



*The Bayferrox manufacturing unit in New Martinsville, West Virginia.*

and using Bayferrox pigments in concrete products. It summarizes the experiences, laboratory tests, and in-plant trials that LANXESS Corporation and our parent company, LANXESS Deutschland GmbH, located in Germany, have accumulated worldwide over the past several decades.

## Raw Materials That Affect Color in Colored Concrete Products

### Pigment

Your choice in pigment is the first, most important decision you make in producing quality colored concrete products. Years of tests on colored products exposed to different climate conditions all over the world have shown that our Bayferrox synthetic iron oxide pigments have superior performance properties in cementitious products.

### Demands Made on Pigments

Pigments for concrete products are required by ASTM C979 to withstand aggressive influences of strong, alkaline cement paste. They must also be lightfast, weather-stable, and insoluble in water. During processing, the pigment must become firmly integrated into the concrete matrix. Inorganic pigments, especially iron oxides, do this particularly well. ASTM limits the amount of pigment added to concrete to 10 percent by weight of the amount of cementitious materials in the mix. All Bayferrox pigments meet ASTM C979 requirements.

### ISO Certification

Bayferrox from LANXESS has ISO certification, which is your assurance that all steps in the manufacturing of Bayferrox have been detailed.



The ISO series of standards was developed by the International Organization for Standardization (ISO) to satisfy the increasing demands of quality-conscious customers. At LANXESS, we are extremely proud that our meticulous detail in manufacturing Bayferrox iron oxide pigments has been recognized with ISO certification.

### Most Important Shades

TRADE NAME	GENERIC NAME	SHADE NUMBERS
Bayferrox Black*	Iron oxide black	300
Bayferrox Red*	Iron oxide red	100
Bayferrox Yellow*	Iron oxide yellow	800 or 900
Bayferrox Brown	Iron oxide brown	600 or 6000
Chrome Oxide Green*	Chrome oxide green	GN or GX

\*Available as powders and granules

From these primary pigments, the most commonly used colors in building materials can be made. By changing the pigment shade, the amount of color added, or the color of the cement and other raw materials, an almost infinite variety of final colors is possible, for example:

Red pigment → Light pink to dark purple

Yellow pigment → Pale yellow to mustard

Brown pigment → From light buff to dark brown

Black pigment → Pale gray to dark charcoal

Green shades can also be produced.

## Cement

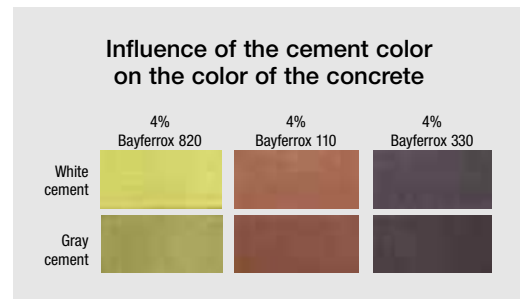
All concrete products contain cement, and the color of the cement affects the final color of the product tremendously. The cement acts as a binder between the sand, aggregates, and pigment in the concrete, holding everything together. It is the cement, and the paste that is created when water is added, that incorporates and binds the pigment particles in the product and prevents them from being washed away.

The most common color of cement is gray. And since the color gray detracts from the brilliance of any color whenever it is used, it is impossible to obtain many bright or

pastel colors using gray cement. Gray cement works best with darker colors such as dark browns, blacks, grays, and many reds.

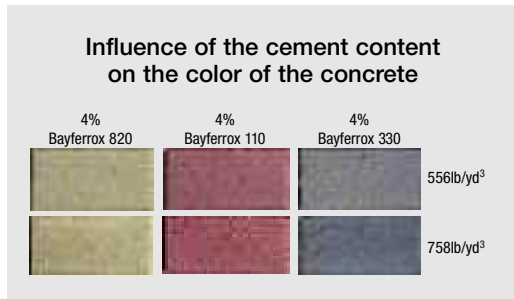
Whenever pastel shades are desired, a manufacturer must use white cement. Light or bright shades of pink, tan, blue, green, and yellow are possible with white cement. With chrome oxide green or cobalt blue pigments, the color difference using white instead of gray cement is pronounced. When white aggregates are used with white cement and pigments, even brighter shades are possible.

Cement companies make many types of cement, and they vary in color from light to dark shades of gray. And as is the case in comparing dry pigment powders, it is not possible to tell final color of concrete by looking at the color of the cement powder. Therefore, to reduce the risk of color inconsistency on the same project, use the same cement supplier and cement type. Whenever changing suppliers, or type of cement, it is important to understand that final color will likely change.



In coloring concrete, the pigment particles are insoluble and 10 times finer than cement. Since cement is the “glue” that holds the concrete product together, it also holds the pigment in place. And since the amount of pigment added to a concrete mix is determined (in percentages) by the total weight of the cementitious materials, as the amount of cement changes so does the amount of pigment and the final color of a concrete product. If the amount of pigment in pounds added were constant, but the amount of cement varied, the one with higher cement content will have a less saturated color.

*Note: Because of variables in photography and printing, the actual color of the concrete products shown may differ from the colors as they appear in the brochure.*

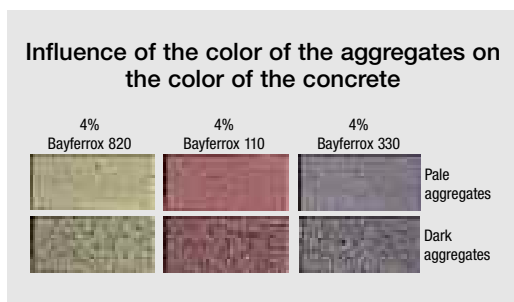


Brilliant, glossy shades, like those of paints or plastics, cannot be attained in concrete products because of the composition and inherent nature of concrete. Further, the smooth surfaces of paints and plastics reflect light differently than concrete, contributing to their brighter appearance.

### Aggregates

In addition to cement, all concrete products contain sand and aggregates, and their color has an effect on the final color of a product since they represent the biggest part of the concrete mix. These aggregates will eventually be exposed after extensive weathering.

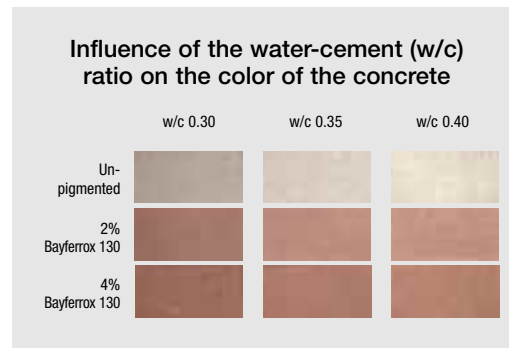
Concrete products can be “washed” or “ground” during manufacturing to remove the colored cement paste, exposing the aggregate color immediately. In either instance, just as with cement color, the natural color of the aggregates has a more marked effect on concrete that’s been colored with a low dosage of pigment than on higher pigment concentrations.



The extent to which color is affected by sand and aggregate depends on the mix design. If the cement to aggregate ratio is 1:10 or higher, more of these particles will be exposed on the surface of the concrete and not coated by the colored cement paste. Consequently, in these formulas, the color of these raw materials – and any variation to them – will show up more.

### Water

When attempting to produce uniform color shades of pigmented concrete, it is important to carefully monitor the amount of mixing water added to the mix, and the moisture content of the raw materials, particularly the sand. Not only does a high water-cement ratio have a detrimental effect on the strength of the concrete, it also makes the product appear a lighter color.



Why is this true? Think about a freshly poured glass of beer. The top of that glass is white foam, while the rest of the glass is filled with beer that is a golden, amber color. That’s because the foam consists of many tiny air bubbles that scatter light making it a very light, bright color. Similarly, in a concrete product, excess mixing water evaporates to the surface and leaves behind many fine pores or cavities – like foam in beer – that make the concrete appear lighter in color. Therefore, the higher the water-cement ratio, the lighter the concrete appears. And this lighter color is true whether or not the concrete has been pigmented.

Consequently, all producers of concrete products must carefully monitor the amount of mixing water and the moisture content of the aggregates to ensure a consistent color in their products.

# Pigments in Detail

## Available Pigment Forms

For decades, pigment powder was the only form of pigment available. Worldwide, powder is the most commonly used form of pigment because it is available in a wide range of colors, and economic advantages make powder appealing. Powder, however, is dusty and does not flow freely. When trying to meter powder to the mixer automatically, there are few systems available.

Today, the concrete product manufacturers have other choices. Pigment can also be purchased as a pre-manufactured slurry. When slurries were first introduced, they provided the manufacturer with a free-flowing, non-dusting product that could be metered automatically. However, freight (shipping water is expensive), availability, cost of coloration, settling, freezing and evaporation problems limit their use.

The latest pigment form makes it possible to meter the pigment pneumatically and very accurately to the mixer in its dry state. At first there were granules made in a spray dryer: many particles of powder combined into pigment “spheres.” Then in 1997, our parent company introduced a patented second generation of these pigments, called Bayferrox C. The “C” is for “compacted” or many particles of standard Bayferrox powders pressed together. Bayferrox C is a free-flowing, low-dusting, and irregularly shaped granule, that is suitable for cementitious applications.

There is not an easy answer to the question, “What type of pigment is best for me?” There are advantages and disadvantages to each. Talk to your Bayferrox representative about the form that best suits your current and future needs.

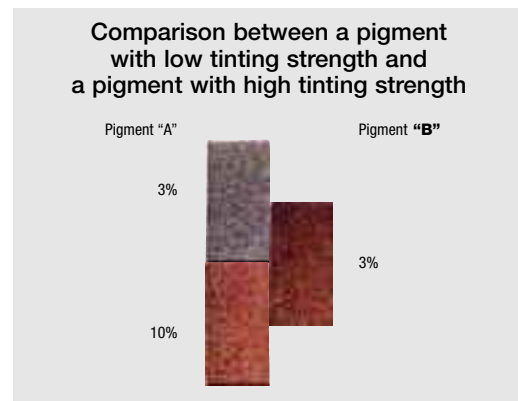
## Tinting Strength

Whenever pigment is used in concrete, it must be added by weight. That weight is determined as a percentage of the weight of the cementitious materials in the mix, typically 3 or 4%. Throughout this brochure, you will notice various percentages of pigment used.

Not all pigments are alike. In their dry state, like colors may appear to be identical, but since pigment is never used without mixing it into something, like concrete, you should never evaluate pigment by itself. Once pigment is mixed into the concrete and the product is allowed to cure, significant color differences between two pigments that appeared similar in their dry state will be visible. This color difference demonstrates the tinting strength – and the color – of the two pigments.



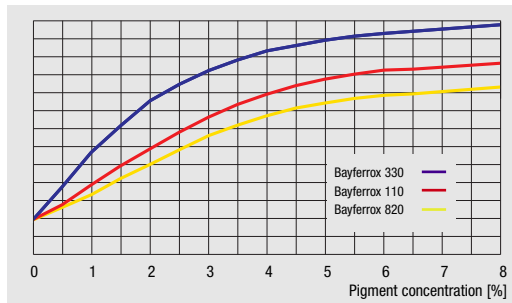
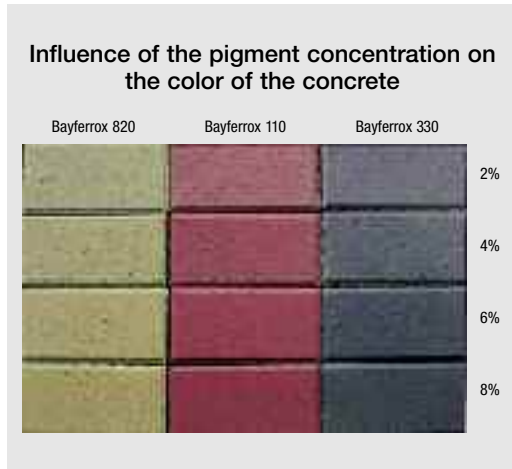
For example, in the picture above, the two red powders look nearly identical. On the left is clay brick dust and on the right is a standard Bayferrox red pigment. But once these “pigments” are mixed in concrete at 6% pigment loading, the resulting color difference is significant.



In the next example, comparing Pigment “A” to Pigment “B” at 3% pigment loading, three different pavers were made. Notice the two pavers using Pigment A, one at 3% loading and the other at 10%. Now compare those pavers to the one made with 3% Pigment B.

At 3% loading of both pigments, the colors look totally different. But when 10% of Pigment A is used, it looks similar in color using only 3% of Pigment B. Therefore, Pigment B is significantly higher (3x) in tinting strength than A. Although A may be less expensive to buy per pound, it may not be the most economical pigment to use.

## Pigment Loading



The chart above demonstrates that as more color is added to concrete, the color changes. On the graph, the color intensity was plotted in terms of reflectance readings as a function of pigment addition. The photos demonstrate actual color change, and you can see that change is significant from 2% up to 6% when using pure synthetic iron oxide pigments. Within the 5 to 6% range, Bayferrox pigments reach their optimum saturation level.

As more Bayferrox is added, there is little difference in the pavers colored from the 6 to 8% loadings. This is demonstrated in both the sample paver colors, and on the graph showing the leveling of the reflectance curve. Therefore, not only is it unnecessary to add this much material, it also becomes uneconomical. It is important to know the optimum pigment loading to achieve the desired color so that only the exact amount of pigment necessary is added to the mix.

## Colorfastness

Colorfastness is the measurement of how fade resistant a pigment is when exposed to the elements over a period of time. Our parent company has conducted extensive tests on pigments used in concrete applications. Shown below is our own weathering station at our headquarters where concrete roofing tiles and other concrete products are evaluated for their colorfastness. Years of experience have proven that only outdoor weathering tests provide reliable conclusions about the weather stability of pigments in concrete. Accelerated weathering tests, conducted with laboratory equipment, do not provide accurate durability data, especially regarding carbon black and select organic pigments.



When pure synthetic or natural iron oxide pigments are used to color concrete products, the pigments don't fade. Rather, as the concrete product is exposed to the elements, the surface of the product erodes. This natural erosion changes the surface of the product: cement and pigment particles are gradually removed, more aggregate particles are exposed, dirt gets ground into the surface, etc. All these actions have a deleterious effect on the color of the product, but the pigment has not faded.

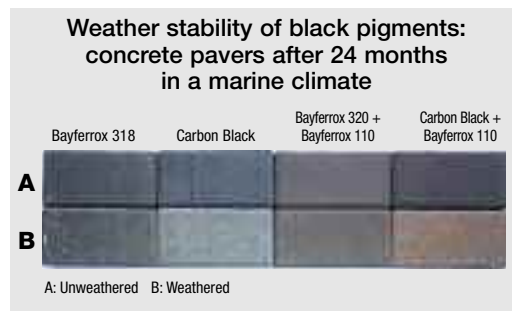


*Exposed and unexposed sample panels*

The sample wall panel of concrete brick on the previous page shows that color change after 25 years of exposure is very little compared to the unexposed samples in front of them, apart from a slight soiling of the surface. As discussed earlier, this is not color fading. Rather, the surface has eroded slightly and the cement matrix (and pigment particles) have been removed.

### Carbon Black

In addition to our own tests, Germany's Federal Institute for Material Research and Testing (BAM) conducted tests of concrete samples colored with carbon black, Bayferrox iron oxide black pigments, and various blends using Bayferrox red (Test Report No. 2.1/21219/5). The results of these tests show that samples pigmented with carbon black fade significantly on exposure to weathering, while only a very slight change in shade is observed in those samples pigmented with Bayferrox black. In products colored with a blend of Bayferrox pigments versus those that used carbon black in the blend, those with carbon black turned red after exposure while those that used the blend of the Bayferrox pigments retained their original dark brown color. Not only does this prove that carbon black fades, but that red iron oxide pigments used in the brown blend are colorfast.



### Organic Pigments

Organic pigments are an excellent choice for automotive, industrial and architectural paints, but most organic pigments do not meet ASTM C979 for coloring concrete products. They are incapable of withstanding the highly alkaline environment of cementitious products. In outdoor weathering tests, concrete products colored with a majority of organic pigments available fade in only a few months.

## Pigment Quantity Affects Color Durability

Remember that cement is the “glue” that holds the concrete product together, that it holds the insoluble pigment particles in place, and that the amount of pigment added to a concrete mix is determined by weight as a percentage of the weight of the cement. As pigment addition increases or decreases, the amount of pigment particles changes proportionally.

On the surface of concrete, there is a layer consisting of the aggregate fines, cement paste, and pigment particles being held in place. The thickness of this layer depends on the mix design, method of compaction, etc. As this layer is exposed to weather and its effects, the fine particles of the cement matrix are gradually worn away, taking away the pigment, while the aggregate particles in the surface become exposed, resulting in the aggregate color contributing more to the overall color of the product.

Consequently, at low pigment loadings, there are fewer pigment particles for the cement to hold into place. Therefore, a color change over time is more visible at low loadings than at a higher pigment loading where you would have more pigment particles being held into place.

# The Production of Colored Concrete Products

## Metering Pigments

Once the form of pigment has been determined, the equipment to meter the pigment must be selected. This can be a daunting task with the numerous choices available, but LANXESS is here to help you. Although we are not in the pigment metering equipment business, we work closely with the manufacturers of various systems. Our representatives are available to assist you in selecting an approved system to meet your needs. Here are some of the more important issues to consider when selecting an automatic pigment metering system:

- Cost of equipment
- Metering accuracy
- Space requirements
- Number of formulas
- Batch cycle time
- Number of mixers

## Measuring Pigments

Dry pigment powders and Bayferrox C must be measured by weight. In most practical cases, an accuracy of +/- 5% per color is sufficient to avoid noticeable color fluctuations. Under no circumstances should dry pigment be added by volume. First of all, pigments have a different volume to weight ratio. Also, the bulk density of a particular grade may vary from shipment to shipment because of different compactions on the pallet, or storage conditions. Therefore, using a coffee can for “weighing” pigment by volume may result in batch to batch color inconsistencies. Pigment slurries can be measured either by weight or volume.

Bayferrox pigments are manufactured in three basic colors: red, yellow and black. Though various shades of these primary colors are available, selecting one standard black and yellow shade, plus two reds – one yellowish and the other bluish – will provide an extensive color range. The most frequently recommended primary colors are Bayferrox Black 330, Reds 110 (yellow-shade red) and 130 (blue-shade red), and Yellow 820 or 920. Incorporating two shades of red provides

greater color flexibility than only one shade; not all dark browns are possible with a warm yellow-shade red, nor are light tans or buffs always possible with a blue-shade red. In the example below, Bayferrox Red is combined with Bayferrox Black to achieve a mid-shade brown.

When using primary pigments at your factory, there is no need to premix them. Pigment metering systems are capable of automatically choosing the right pigment(s), measuring the exact quantity necessary, and transferring the pigment to the concrete mixer where the blending takes place.



In addition to offering the basic red, yellow and black colors, LANXESS offers custom blends, and a wide range of standard brown shades, by premixing various primary powder pigments together.

## Mixing Pigment in the Concrete

Once you have selected the pigment form and the appropriate metering system to meet your current and future needs, we recommend the sequence below for adding color to the mixer.

### CORRECT MIXING SEQUENCE FOR PROPER DISPERSION OF ANY TYPE OF BAYFERROX PIGMENT

1. Add sand and aggregates
2. Add Bayferrox powder or C grade pigment(s)
3. Mix for 30 seconds, minimum
4. Add cement
5. Add remainder of mixing water
6. Mix until homogeneous

Since pigment powder is such a small particle-sized material, care must be taken to ensure complete dispersion in the mix. As a general rule, a premixing of pigment powders or Bayferrox C, sand, and aggregates is most advantageous. The coarser aggregates act as “dispersion aids” and help to distribute the pigment particles evenly. Then the specified amount of mixing water



is added and mixed until homogenous. When making your own pigment dispersions, or purchasing pre-manufactured pigment slurries, a pre-wetting is recommended.

Otherwise, problems may occur such as streaking or the creation of pigment spots.

If lightweight aggregates are used, it is necessary to prewet the aggregates. This procedure permits the water to fill the pores of the aggregates. The mixing then may be completed as suggested above.

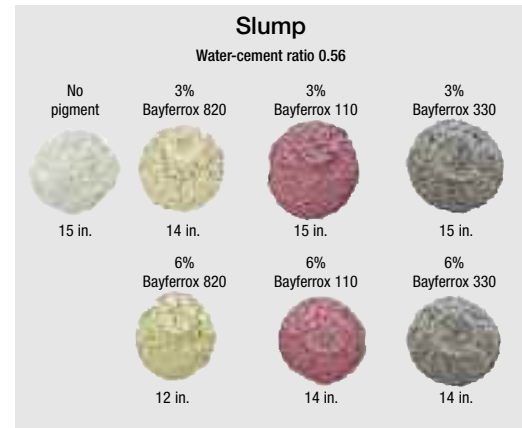
## Pigment Effect on Concrete Quality

ASTM C979 limits the amount of pigment added to concrete to 10%. Care must be used when using weak pigments – those with lower tinting strength – because color saturation is not reached until much larger amounts of pigment are added. The amount of these pigments required to produce a given shade can sometimes be so large that the increase in the amount of fines added to the mix has a negative effect on the technical properties of the concrete and exceeds ASTM limitations.

Blaine is a relative measure of the specific surface area of cement, but pigments do not follow this measure since their fineness differs depending on the type of pigment. As a general rule, however, most Bayferrox pigment powder would be approximately 10 to 20 times finer than cement. But with the Bayferrox pigment grades most commonly used in concrete, these pigments have a nominal effect on the processing properties of concrete considering the particle size of the pigment, particle shape and chemical composition.

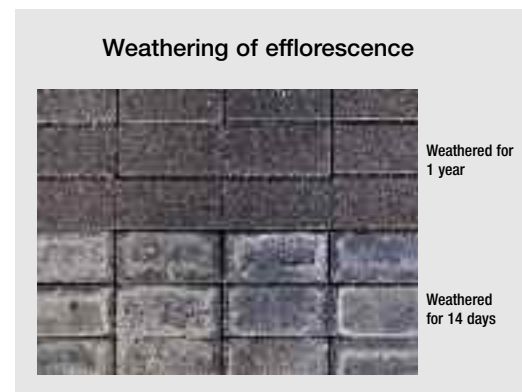
Yellow pigments have a needle-shape structure while red pigment is spherical and black pigment is cubical. As such, yellow pigments have a higher water demand. This effect is noticeable only with pigment loadings above 5%. If more than 5% yellow pigment is added, this will lead to a reduction in the effective water-cement ratio and changes in the consistency of the concrete. If you compare the addition of yellow pigment to unpigmented concrete, it may be necessary to increase the amount of mixing water in order to obtain the same consistency, or workability, at higher pigment loadings.

## What Else Affects Color?



## Efflorescence

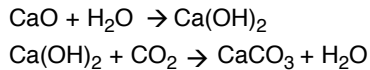
Anything made from cement is susceptible to efflorescence. It is important to note that our Bayferrox and Chrome Oxide Green pigments do not have any influence on the creation of efflorescence, nor can they pre-



vent it from happening. To some degree, efflorescence always occurs. But when it appears on products that are colored, it seems more visible and customers complain more.

Primary efflorescence is the result of free lime in the cement being dissolved in the mixing water and working its way, as hydrated lime, to the surface of the concrete where it reacts with carbon dioxide in the air to form insoluble calcium carbonate. Secondary efflorescence is the same phenomenon, but it occurs after the concrete has cured when rainwater or dew brings hydrated lime or calcium hydroxide to the surface. Therefore, porosity of concrete plays an important role in efflorescence. The less porous the concrete is, the lower the tendency

for efflorescence to occur. The chemical formula for this reaction is:



How does it go away? In a subsequent reaction, the hard insoluble calcium carbonate on the surface of the concrete reacts with carbon dioxide from the air that's been dissolved in water, to form calcium bicarbonate, which in turn, is soluble in water. This reaction can take from 15 to 24 months. Therefore, weather plays an active role in the creation and removal of efflorescence. Also, since rain is necessary for removing efflorescence, this process will take much longer in arid climates.

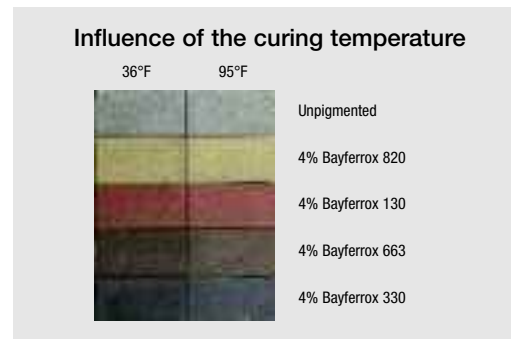
More detailed information on this phenomenon is available from LANXESS.

## Curing

Since curing temperature affects the color of unpigmented concrete, it will also influence the color of concrete that's been pigmented. This is due to changes curing imparts on the size and shape of the cement crystals.

Hardened cement paste, or stone, which is formed from the reaction between the mixing water and the cement, produces calcium silicate crystals of various sizes depending on the curing temperature of the concrete. It is the size and irregular shape of these crystals that affects the way light is scattered. Consequently, this changes the appearance of the colored concrete product. As the curing temperature increases, the crystal structure of the concrete becomes more irregular. This results in more porous concrete, which increases light scattering, and the lighter appearance of the concrete. This color difference is most apparent when concrete is cured at elevated temperatures compared to concrete cured at ambient temperatures.

Whenever autoclaves are used, the color difference (compared to normal room temperatures) is even more pronounced. First of all, even in unpigmented concrete, the cement crystals are affected, resulting in



extremely light gray concrete. When pigment is added to autoclaved products, especially black or dark brown shades, these higher temperatures may also affect the pigment itself. That's because black iron oxide pigment starts to oxidize to brown pigment at 180°C (356°F) and eventually to red as the temperature increases. Therefore, if the concrete is autoclaved at 200°C (392°F), a color change from black to reddish brown shade is likely. Also, if dark brown pigment is used (a combination of black and red pigments), a color change is likely for the same reason. LANXESS Corporation offers special temperature-stable pigments-Bayferrox 645T brown and Bayferrox 303T black-which are capable of withstanding these higher temperatures. The use of any standard red or yellow iron oxide pigment is unaffected by normal autoclaving.

## Admixtures

Admixtures are those ingredients in concrete other than Portland cement, aggregates, and water, that are added to the mixture immediately before or during mixing. Given this definition, pigments are classified as admixtures. The most common admixtures are air entraining agents, water reducing agents, accelerators, mineral admixtures (pozzolans), and water repellants. Each type of admixture has a different effect on the color – and appearance – of the concrete product.

Air entraining admixtures are used to improve freeze/thaw durability by creating microscopic air voids. These voids allow for expansion and contraction of the frozen water, thereby reducing scaling. These air voids are present throughout the concrete. On the surface of the concrete, this causes an increase in light scattering, which results in the appearance of a lighter color.

Water-reducing admixtures are used to reduce the quantity of mixing water needed in the concrete mix while maintaining a high level of workability. The reduction of water increases the strength of the con-

crete. This also results in fewer pores on the surface. The decrease in porosity lowers light scattering, which results in the appearance of a darker color.

Accelerators are added to the concrete mix in order to decrease setting time and increase high-early strength. The addition of accelerating admixtures usually results in a darker color because of the early setting of the concrete, and because of that, the chance of the formation of efflorescence is somewhat lessened.

Pozzolans are used to increase workability and to replace cement. In general, pozzolans are lighter and finer than Portland cement, which may result in a lighter color of the concrete. Certain pozzolans, however, can behave slightly as plasticizers. This plasticizing effect could allow for a reduction in the amount of water that would result in a darker color.

Water repellants decrease the water permeability of the concrete. In general, there is no effect on the color of the concrete.

### Admixtures by Classification

Type of Admixture	Material	Desired Effect	Effect on Color
Air Entraining (ASTM C260)	Salts of wood resins Some synthetic detergents Salts of sulfonated lignin Salts of petroleum acids Salts of proteinacious material Fatty and resinous acids and their salts Alkybenzene sulfonates	Improved durability	Normally makes color lighter
Plasticizer (ASTM C494, Type A)	Lignosulfonates Hydroxylated carboxylic acids (also tend to retard set, so accelerator is added)	Reduce water required for given consistency	Initially darker; reduced color effect in later stages
Accelerator (ASTM C494, Type C)	Calcium Chloride (ASTM D98) Triethanolamine	Accelerate setting & early strength development	Darker color
Pozzolan (ASTM C618)	Natural Pozzolans (Class N) Fly Ash (Class F and G) Other materials (Class S)	Reduce costs; improved workability and plasticity.	Typically lightens but may darken due to plasticizing effect; inherent color affects final color also.
Water Repellant	Stearate of calcium, aluminum, ammonium, or butyl Petroleum greases or oils Soluble chlorides	Decrease permeability	Possibly darkens color

The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise

### **Health and Safety Information**

Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the LANXESS products mentioned in this publication. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper

use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and product labels. Consult your LANXESS Corporation representative or contact LANXESS's Product Safety and Regulatory Affairs Dept., Pittsburgh, PA. agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.

use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and product labels. Consult your LANXESS Corporation representative or contact LANXESS's Product Safety and Regulatory Affairs Dept., Pittsburgh, PA.

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Note: The information contained in this bulletin is current as of November, 2004.  
Please contact LANXESS to determine if this publication has been revised.