



THE  
CONCRETE COUNTERTOP  
INSTITUTE

Your complete resource for concrete countertop success.

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The Concrete Countertop Institute recommends using metakaolin as a cement replacement in concrete countertop mixes, instead of other pozzolans such as silica fume, to:

- Boost compressive strength
- Make finishing easier
- Reduce efflorescence
- Mitigate alkali-silica reaction
- Maintain color, especially in white concrete

Below is information about what metakaolin is, how it works, and how to use it in concrete countertop mixes.

## What is metakaolin?

Metakaolin is refined kaolin clay that is fired (calcined) under carefully controlled conditions to create an amorphous aluminosilicate that is reactive in concrete. Like other pozzolans (fly ash and silica fume are two common pozzolans), metakaolin reacts with the calcium hydroxide (lime) byproducts produced during cement hydration.

## How does metakaolin boost compressive strength?

Calcium hydroxide accounts for up to 25% of the hydrated Portland cement, and calcium hydroxide does not contribute to the concrete's strength or durability. Metakaolin combines with the calcium hydroxide to produce additional cementing compounds, the material responsible for holding concrete together. Less calcium hydroxide and more cementing compounds means stronger concrete.

## How does metakaolin make finishing easier?

Metakaolin, because it is very fine and highly reactive, gives fresh concrete a creamy, non-sticky texture that makes finishing easier.

## How does metakaolin reduce efflorescence?

Efflorescence, which appears as a whitish haze on concrete, is caused when calcium hydroxide reacts with carbon dioxide in the atmosphere. Because metakaolin consumes calcium hydroxide, it reduces efflorescence.

## How does metakaolin mitigate alkali-silica reaction?

Alkali-silica reaction is a reaction between calcium hydroxide (the alkali) and glass (the silica) which can cause decorative glass embeddings in concrete to pop out. Because metakaolin consumes calcium hydroxide, it takes away the alkali and the reaction does not occur.



## How do I use metakaolin?

Our experience has shown that optimal performance is achieved **by replacing 10% to 15% of the cement with metakaolin**. While it is possible to use less, the benefits are not fully realized until at least 10% metakaolin is used.

The advantage of replacing some of the cement with metakaolin, rather than simply adding metakaolin to the mix, is that any existing color formulas or mix designs won't change, or will only very slightly change. This is because the dosage of pigments and superplasticizers are based on the cement content in the concrete.

Of course, it is OK to simply add metakaolin to an existing mix, but it's important to realize that the total equivalent cement content will increase. Be aware that this will affect not only the pigment and admixture dosages but also the water to cement ratio, a critical factor in mix design.

How well metakaolin behaves depends on your mix design and, more critically, on how much mix water is used. Keep in mind that any admixture must be used wisely. All the other factors (good mix design, proper reinforcing, etc) must also be properly designed and accounted for in order to take advantage of the benefits metakaolin can give you. For example, making a very high compressive strength concrete is pointless if the reinforcing is inadequate.

## Is metakaolin compatible with other admixtures?

Metakaolin is compatible with most concrete admixtures, such as superplasticizers, retarders, accelerators, etc. If questions arise as to compatibility with any admixtures you use in your mix, consult with the admixture manufacturer for guidance.

## What effect does metakaolin have on colors?

Burgess OPTIPOZZ® is a very white metakaolin. Whiteness is a huge advantage over other pozzolans such as silica fume, which is a dark steel-gray, or fly ash, which is a lighter grayish color. Because Burgess OPTIPOZZ® is light creamy-white in color, it does not affect the color of white concrete made with white Portland cement.

Metakaolin may brighten some integral pigments. Test your color formulas to make sure that they come out the same (or better) with the use of metakaolin.

## What effect does metakaolin have on acid stains?

Because metakaolin aggressively consumes calcium hydroxide, acid staining concrete with metakaolin added to it might lead to disappointment. Acid stain needs the calcium hydroxide to react, and without enough of it in the concrete, the acid stain color might not develop enough, or even not develop at all.



## **Do I need to change any of my casting, finishing or curing methods when using metakaolin?**

Concrete made with metakaolin can be cast, finished and cured in almost the same fashion as ordinary concrete made without metakaolin.

Metakaolin complies with ASTM C618 - Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete, Class N, and is accepted under ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

## **How much metakaolin do I need?**

Burgess OPTIPOZZ® metakaolin is supplied in 25-lb and 50-lb bags.

One 25-lb bag of metakaolin will produce about 50 to 81 square feet or more of 1-1/2" thick concrete countertops, depending on the mix design. (This translates to roughly 6.25 to 10 cubic feet of concrete.) Given that the average kitchen is about 50 square feet, one 25-lb bag of metakaolin should make somewhere around 1 to 1 ½ kitchens for you.

A pallet (50 25-lb bags) would make 48 to 72 kitchens. That's around 4-6 kitchens per month if you figure a pallet would be a year's supply of metakaolin. If you're talking about a pallet of 50-lb bags, that's 8-12 kitchens per month. If you are not at that production level, buying a few 25-lb or 50-lb bags at a time makes a lot more sense than buying a whole pallet. That is why The Concrete Countertop Institute is so pleased that Burgess Pigment Company has agreed to provide smaller quantities of metakaolin to concrete countertop makers.

## **Where can I find more information about metakaolin?**

Burgess Pigment Company has information about their OPTIPOZZ® product at [www.optipozz.com](http://www.optipozz.com).

