"The Buzz"

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NEW PARTNERSHIP

Mt. Savage Specialty Refractories (MSSR) has strived to provide quality refractories for a variety of applications through the years. MSSR produces some of the world's most unique and most consistent specialty refractories in the world. We also supply quality fireclay and high alumina brick from Mt. Savage Firebrick (no ownership connection) and Snow Shoe Refractories. Now, through KilnTec, of Florida, Mt. Savage has access to magnesite-spinel bricks made by Krosaki AMR in Spain. These brick are made with the highest quality magnesites and spinels to produce what we believe are the best Mag-Spinel brick available.

KilnTec is also increasing the exposure of MSSR specialty products to the cement and lime industry by using their representatives to offer MSSR products. This brings quality specialty products to a much larger part of the country. Thus, both MSSR and KilnTec can offer high quality brick and specialty refractories for all the needs of cement and lime customers. For more information, contact your local MSSR representative today.

Those of us at Mt. Savage Specialty Refractories want to wish everyone a joyous Holiday Season. We also want to take a stand with our French brothers and sisters and say that the victims and their families of the vicious terrorists attacks of November 13 are in our thoughts and prayers. May the coming Holiday season and New Year bring peace and understanding throughout the world.

LOW or NO

You are looking at a repair or a new furnace construction and you want to gun it. Newer technology, be it either no or low cement gunning mixes, offers significant advantages over older technologies. The properties and cost/benefit ratio of higher density, clay free gunning mixes are often an obvious choice over older, high cement, clay bonded technologies. But what should you choose, low cement or no cement gun mixes? It depends.

There are advantages and disadvantages to both systems. If you are looking for low to intermediate temperature strength and abrasion resistance, low cement, like **ULTRA-TEK 60 GM** is the way to go. The material develops good strength once dried and maintains very high strength through 2200°F. It is particularly good for full wall construction in abrasion applications such as cement kiln preheat towers. Chemical resistance to alkali and acids can be enhanced and tends to be much better than higher cement mixes, but these factors should be considered in your selection.

No cement products, such as **SAVAGE X™ 60 GM** have some significant advantages over the low cement systems. Almost by accident, they gun better than their low cement cousins. They have tremendous resistance to both acids and alkali, and particularly chlorine. It is easy to say that they are just more chemically resistant than low cement products across the board. At high temperatures above 2200°F, the bonding phase of these products turns to mullite, where in low cement products it does not. This makes these products better choices for high temperature applications above 2200°F and particularly at iron and steel making temperatures. Another advantage of no-cement systems is the lack of hydration phases makes the thermal expansion of these products on initial heat up much more like that of a used refractory furnace lining. Thus, they bond much better than cement containing refractories to used linings, by not developing a shear plane during heat up, making them an ideal repair gunning material. They also gun extremely well onto a hot surface.

It is important to remember that neither of these systems contain any crude clay. To become sticky, they are dependent on soluble chemicals that have to dissolve to be effective. Thus, it is critical that good water pressure is needed to gun these products with low rebounds and dust. A water booster pump cannot be recommended strongly enough when gunning these products! Every case we have seen of reported high dust or high rebounds with these products has been solved by adding one.

Is Strength Important?

Strength, as shown by modulus of rupture (MOR) or cold crushing strength (CCS) on a data sheet, is often the first thing a potential customer looks at on a refractory data sheet. The general thought is the higher the better. Though it is generally true that high strength is not a detriment, the question should be asked, is high strength important in your particular application? The reason it is important to ask that question is that other factors may be much more important to wear and products with lower strengths may work much better for you.

Let's start with areas where strength is important. Where abrasion is the wear mechanism, there is a strong correlation between strength and abrasion resistance. Abrasion occurs anytime hard particulates are present in a moving air stream. Cold crushing after a 1500°F reheat is often a good indication how well a product will hold up in these areas. In other applications where mechanical de-sculling occurs, strength is also important. This could be true of upper sidewalls of aluminum dross furnaces or steel ladles. These processes are often done hot, so strength at temperature is certainly a factor.

Modulus of Rupture being tested on a refractory sample.

In most applications, strength is not the primary wear mechanism. Thermal shock resistance often has an inverse correlation to strength and is often much more significant in wear. Applications that see large temperature changes, even with long cycles, often show thermal shock wear with time. This would include vessels like reheat furnaces, cement and lime coolers, and boilers. Chemical attack is another concern, and thus resistance to things like alkalis, acids, chlorine, and hydro-carbons

Continued on Pg. 4—See "Strength"

DATA SHEET PROPERTIES

When bidding to a specification, one often compares data sheets with the spec, but what really is a data sheet? With raw material changes and some refractory manufacturers looking to cut costs in material design, does the existing data sheet truly reflect the actual properties that can be expected from a product? Some of the properties on data sheets can be misleading. How do you avoid the trap of something looking really good when, in reality, it reflects a weakness in a system?

Refractories are tested using methods developed by the American Society for Testing and Materials (ASTM). By using these methods, the variation in results for an identical product will be minimized from lab to lab. For instance, the load rate on a strength tester will have a significant impact on the strength number obtained, the faster it loads, the higher the number will be. ASTM defines the load rate to use for testing so that numbers will not vary significantly because of that factor.

What starts to get tricky is strength (either MOR or CCS) “after” or “at” temperature. Specialty products are typically tested for MOR after drying and after 1500°F. The reason 1500°F was originally used is that it represented a temperature that fully dehydrated cement containing specialties, but is low enough before sintering or melting of refractory materials occurs. This makes it the temperature where conventional castables or gunning mixes are at their weakest. This isn’t true for low and ultra-low cement products that have other types of bonding phases forming, but is often reported out of inertia from past years.

Strengths at and after 2000°F start to become interesting, and the reader of a data sheet has to be clever to understand what they mean. When it says “at” a certain temperature, that is easy, the sample is put in a furnace, heated and held for at least 4 hours at a certain temperature, and the strength test is run. When it says “after”, the sample is heated to that temperature, held for a certain time, then allowed to cool before the strength test is run. At temperatures at or above 2000°F, “at” is a much more useful number as it tells you how strong a material is at that temperature. If a material shows a huge drop at a temperature it is an indication that the material is starting to melt a little and is losing strength. The same material that shows a decrease in strength at a given temperature that is heated to that same temperature and allowed to cool will very likely show a much higher strength when MOR is then run at room temperature.

The reason for this is that the liquid that causes it to have a low hot strength will solidify and will give the material a very strong glassy bond at room temperature. Thus, when you see a very high strength “after” a given reheat temperature, that should be a warning sign that material may have developed liquid at that temperature and is not well suited to be used at that given temperature. This is why current issued MSSR data sheets do not have strength after high temperatures as that number can be misleading to a non-refractory expert (or non-Buzz Newsletter reader).

Another caution on data sheets is that the information on some of the products may be based on a very limited amount of data and should certainly not be used for compliance information. Even MSSR, when it comes out with a new product, will often only have one or two sets of data to base a data sheet on. Thus, there is no indication how much this particular data may vary. Also, data sheets are based on laboratory installation conditions, so the “typical” data on the data sheet may really mean, the best data you could hope for in the field. Everyone is testing under laboratory conditions, so it could still be useful to compare numbers from responsible refractory vendors.

Another factor in looking at a data sheet is the date on the sheet. Raw materials and mix formulations change with time, sometimes they get better, sometimes they don’t. When comparing a data sheet make sure you have the most recent one from the supplier and ask the company representative if that data reflects the current production of that product.

Finally, make sure you are using the right product type for your application. Because something was specified 20 years ago doesn’t mean it is right for today. A considerable amount of new technologies such as no cement bonds, lightweight pumpables, gunnable plastics, and low cement gun mixes have hit the market in the past 20 years, and MSSR has contributed significantly to this new product list.

Stinger says “Always check with your supplier to make sure that the data sheet you are using reflects the current mix and properties of what you would be getting.”

Continued from Pg. 2 "Strength"

can be much more important than strength. Simple over-heating is an issue in some cases, and total refractoriness can be more important than cold strength, though strength at temperature can be a good indicator of refractoriness.

On some data sheets, a totally misleading property is often included, this being strength after a high temperature reheat. Depending on the system, it is often the case that the higher the number here, the less desirable the product is. A product that partially melts at a reheat temperature will fuse together and be very strong when measured cold. Thus, a product with a MOR twice dried after heating to 2700°F will likely not have very good hot strength at that temperature due to liquid formation, not a good thing.

Therfore, the next time a salesperson comes into your office and points out their product is stronger than the one you are using, ask yourself, does strength have anything to do with how our refractory is wearing. If not, paying a penny extra for higher strength is like paying extra for an option that you don't want on a new car. Isolating the cause of refractory failure and addressing that with proper refractory selection is the way to go. Luckily, there are lots of options in today's refractory world that didn't exist in years past to address those pesky refractory problems

Eirich Mixer

The new Eirich mixer is up and running at Curwensville and immediate positive results have been noted. Production of plastics have doubled and better mixing action has made a noticeable improvement in plastic cohesion. Even in this down market, Mt. Savage plastic sales are up considerably since the mixer has been installed. Other improvements to the plastic line have led to better packaging and higher production rates. Contact your local MSSR sales rep for more information.

Ask Dr. Dirt

Dear Dr. Dirt, Can no cement gunning mixes be gunned overhead? We have a high wear dome area with high chlorines, would love to put a no cement product there, but it is difficult to repair without gunning. **Vertical in Allentown**

Dear Vertical: You are right to consider no cement products in chlorine gas streams. Chlorine will react with the lime in cement to form calcium chloride and disrupt the bond and weaken the product. The no cement systems of silica gel, alumina gel and alumina-phosphate are all immune to this reaction.

Though not all no cement systems can be gunned overhead, **SAVAGE X™** certainly can be. . At the end of this paragraph I reference a short you tube video showing **SAVAGE X™ 60 GM** being shot overhead from some distance, 10 inches thick. I strongly recommend using a water booster pump to do this, but you can see that it gunned very well with low rebounds and dust. Dr.Dirt

https://www.youtube.com/watch?v=csPGuIWmO1U

Dear Dr. Dirt, What causes thermal shock damage? **Cracking in Houston**

Dear Cracking, The simple answer is differential expansion. Almost all materials when heated expand, at least within their phase state (solid, liquid, or gas). In the case of refractories, materials are usually heated from one side with the hot face becoming hotter than the cold face making the hot face expand more. As ceramics tend to be very strong in compression and an expanding hot face will put the surface in compression, thermal shock is less likely to occur during heat up. During cool down, however, the hot face will become cooler for a period of time than the material beneath the surface, and shrink in comparison. This puts the hot face in tension, and ceramics are not proportionally strong in tension, thus prone to cracking. The faster you cool the surface, the bigger the temperature difference, the bigger the size difference, and thus the more likely the thermal shock.

Different refractories expand at different rates with temperature so they tend to have different ability to withstand thermal shock. Fireclay expands less than tabular alumina which expands less than high purity magnesite. Thus, everything else being equal, magnesite will be more prone to thermal shock than fireclay. Fused silica has almost no thermal expansion, a very low coefficient. Therefore, fused silica refractories can take wide temperature swings without damage as long as the material stays in its fused, i.e. amorphous form. Dr. Dirt