CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
S0214

Project Title
Refractory: The Ideal Proportion

Abstract

Objectives/Goals
The goal of this experiment was to find the most insulating, durable and inexpensive refractory material for utilization in the non-ferrous industry.

Methods/Materials
Two identical groups of samples with varying proportions of the minerals kaolin clay and silica sand were created for consistency purposes. Both materials are extremely inexpensive relative to currently utilized refractors. All samples were measured for weight, and not volumetrically. After the ceramic samples cured, they were measured for weight loss due to cracking. They were also measured by use of a .001 inch caliper for diameter shrinkage. They were then fired to cone 04, or 1900 degrees Fahrenheit. The samples were tested for shrinkage in both weight and size just as they were measured pre-vitrification, after the firing. The sample groups were finally tested for density, indicative of future insulating power.

Results
It was found that a proportion of 65% kaolin and 35% silica in units of weight is ideal for the perfect balance of durability and insulating power. Samples with higher proportions of kaolin shrank and cracked far too much, rendering them impractical for industrial use, while samples with higher proportions of silica would not vitrify correctly. The 65/35 ratio is ideal.

Conclusions/Discussion
The foundry industry is directly or indirectly tied to 95% of manufacturing in the United States. It is, therefore, imperative that the industry is supplied with an inexpensive, durable and insulating material. Refractory is a consumable material, and the less a foundry uses, the more money it will save. The perfect balance of the two inexpensive refractors would prevent countless unnecessary monetary expenditures from the already struggling domestic foundry industry. These data shows that if the eco/bio friendly 65% kaolin and 35% silica proportion were to be utilized, the domestic non-ferrous foundry industry would benefit immensely.

Summary Statement
To find an inexpensive, durable, insulating eco/bio-friendly alternative to refractory currently utilized in the non-ferrous industry.

Help Received
My ceramics instructor, Katherine O'Brien, fired both groups of samples to the exact same temperature, using an electric induction kiln. She also clarified the intricacies of ceramics at the molecular level, pertaining to platelets and vitrification.