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"HOT TOPICS"

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Controlling The Finish Of Green Sand Castings

Using Combustible Additives

The control of combustible additives can be very effective in producing casting peel and the removal of sand at the shake out. This can be a cost reduction incentive. The organics that contain carbon produce a very beneficial reducing atmosphere during the casting of gray and ductile irons. The moisture used to plasticize the bonding clay produces an oxidizing atmosphere within the mold. Additives such as wood flour, oat hulls, ground corn cobs, also produce a partial reducing atmosphere which neutralizes the effect of the moisture that they contain. Therefore it is considered good foundry practice to provide sufficient volatile material. The oxidizing atmosphere caused by moisture will contribute to slag inclusions, burn-on, burn-in and penetration if not neutralized.

Ductile and gray iron metalcasters have determined through production experience that maintaining a minimum of <u>2.0% volatile, combustible</u> material should be the target. However, there may be other factors that are influential and should be taken into consideration. Other major factors can be mold compaction, permeability and venting practice.

Factors That Affect Peel

* Amount of volatiles, that produce a reducing atmosphere, contained in the molding sand system.
* Uniformity of mold compaction and degree of mold hardness which determines mold permeability.
* Amount of cores, type of core binder and total amount of unburned core sand returned to the system.
* Fineness of the seacoal.
* Moisture content of the molding sand.
* Degree of venting of molds and cores providing oxygen to support burning.
* Casting design, geometry and susceptibility of the molten metal to be free of gas entrapment during the casting process.
* Method of mold making process, ie; horizontally or vertically parted.
* The speed of pouring and the possibility of <u>pouring impact</u> increasing pressure and reducing the time of volitization.
* The efficiency and control of dust collection to remove fines and organics.

For these reasons, and there may be some other rare exceptional influential cases, the actual measurement of potential reducing atmosphere volatiles is important.

It should be mentioned that the increased cost of additives which produce a reducing atmosphere, far outweighs the increased cost of cleaning sand from the castings. It also reduces the cost of machining the castings.

The following calculations and typical examples are offered for those who have testing facilities and technical staff to utilize the technology for profit and quality improvement. It is highly recommended that a survey be made of the current testing procedures. A standard, reproducible, accepted method using the correct crucibles and furnace temperature control is required. Then target a volatile level to yield a range of acceptability at the top level of moisture content permitted in the sand. Consideration should be given to changing and tweaking the organic composition of the formula to achieve "consistency" when casting weights and sizes change (higher or lower than normal) for extended periods of time.

Unmeasured Volatiles

Recycled system sand contains other volatiles consisting of unburned core binder, chemically held moisture in bentonite, and other materials such as riser sleeves etc. This represents a very minute amount that contributes to the total burn-out. Of these, the organic core binder volatile has value that contributes to casting peel. Sand systems that have more than 20% of the mold containing cores, yield enough volatile to be considered. However the exact amount, with inconsistent burn-out or core disintegration is difficult to measure. For these reasons we are not including these unknowns in the calculations. In most cases they will be somewhat constant, and only need to be considered when there are wide variations in core use.

Typical Examples of Organic Composition Based On Loss On Ignition
(Not including other miscellaneous materials in the sand)
Commercial Seacoal Analysis

MOISTURE	4.9%
VOLATILES	38.1%
ASH	5.0%
SULPHUR	0.7%
FIXED CARBON	56.9%
L. O. I.	95.0%
COKE BUTTON	0.2%.

Examples Of Calculations Using Seacoal Analysis From Above

Example #1 Assumes L.O.I. (from seacoal) @ 1650F of the prepared sand is 4.5% or 4.5#/100
4.5 pounds x .381(volatiles) = 1.71 pounds or 1.71%
4.5 pounds x .049(moisture) = 0.22 pounds or 0.22%
Total evolved = 1.93% (of which only 1.71% is reducing in nature)

Example #2 Assumes L.O.I. (from seacoal) @ 1650F of the prepared sand is 5.0% or 5.0#/100
5.0 pounds x .381 (volatiles) = 1.91 pounds or 1.91%
5.0 pounds x .049 (moisture) = 0.25 pounds or 0.25%
Total evolved = 2.16% (of which only 1.91% is reducing in nature)

Example #3 Assumes L.O.I. (from seacoal) @ 1650F of the prepared sand is 5.5% or 5.5#/100
5.5 pounds x .381 (volatiles) = 2.10 pounds or 2.10%
5.5 pounds x .049 (moisture) = 0.27 pounds or 0.27%
Total evolved = 2.37% (of which only 2.10% is reducing in nature)

Note: The remaining organic contained in seacoal (56.9% as fixed carbon) will burn out at a temperature over 1200F and contribute to better shakeout but will not improve peel. The sulphur contributes to the pungent smell evolved during casting and can react with othe elements in the casting process. Ref. (DIS #17, "Sulphur in Molding Sand" by George Disylvestro, 1992)