Technical Data Sheet

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BETASET

Background

Over the last 20 years, cold curing chemistries have come to the forefront in the foundry industry. The major advancements have been in the vapor cured area - Cold Box. Unfortunately, along with the benefits of amine or SO_2 vapor cured systems came several significant drawbacks, the most notable relating to environmental aspects and certain casting defects.

Foundries needed a vapor cured system that provided more favorable environmental characteristics and improved casting quality in order to increase the profitability of making castings. Following years of research and development, HAI offers patented chemistry, **THE BETASET PROCESS**.

The BETASET Process

The BETASET Cold Box Process incorporates many of the advantages of previous cold box technologies while eliminating most of the disadvantages. The chemistry of the system is similar to that of the **ALpHASET® SYSTEM**, which has proven to make excellent castings and reduce cleaning room time.

This patented process offers many advantages over amine, SO_2 or CO_2 cured cold box systems. The advantages listed below relate to one or more of the competitive systems.

- No or Low Nitrogen
- No Sulfur
- No Unpleasant Odors
- Reduced Expansion Defects
- Utilize Any Raw Sand
- Utilize Reclaimed Sand
- Good Core Storage
- Potential for Reduced Emission Control
- Utilize Plant Air
- Good Shakeout in Aluminum Applications

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General Characteristics

The **BETASET PROCESS** has two distinct advantages over other existing organic cold box systems, specifically; environmental improvement and casting quality. The environmental improvement is due to the fact that the resin is water based and therefore does not have the odors or VOC issues associated with solvent based systems. The methyl formate curing agent, BETACURE® 100, has no apparent unpleasant odor under normal conditions. This characteristic makes the BETASET PROCESS more acceptable to employees.

The casting improvements are in several important areas:

1. Reduction of casting expansion defects because of the thermosetting nature of the binder system.
2. Reduction in casting defects because of the elimination of sulfur and minimal nitrogen.
3. Elimination of carbon flotation defects

Components

Unlike other cold box systems, the **BETASET PROCESS** has only two parts; the resin and the curing agent. The resin is an alkaline phenolic resole in water, and the curing agent is the vapor of a volatile ester, methyl formate. Unlike other organic cold box systems, the vapor is consumed during the reaction. It does not perform the function of a catalyst like amine or SO_2, remaining unchanged, but rather is a hardener and is consumed. No other additives such as iron oxides, clays, etc. are generally required.

Mix Levels

The BETASET resins are used in conventional quantities on sand. A range from 1.0% to 2.0% (based on the weight of sand) is typical. The specific level is contingent upon sand type, fineness and strength requirements. Acid demand or small amounts of moisture in the sand do not appreciably affect the cure rate. The resin theoretically requires at least 20% ester by weight to fully cure. In actual practice, ester consumption will be substantially higher based upon core box configuration, venting and sealing. Levels of 30-50% based on binder weight are common.

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Mixing Equipment

Any good mixing equipment can be used with the BETASET PROCESS. Mixers which do not introduce large volumes of air into the sand mass are better and more efficient because they minimize evaporation of water from the mix. Loss of moisture reduces flowability of the mixed sand.

Sand Mix Life

The sand mix life is generally more than adequate for production needs. Since there is only resin and sand in the mix, no chemical reaction takes place. To extend the mix life, it is important to keep the sand from drying out or crusting over.

Vaporizers - Generators

The gas generator must be specifically designed for the **BETASET PROCESS**. Amine or SO_2 generators do not work well but in some cases units can be modified to perform satisfactorily. Consult your H A INTERNATIONAL, LLC representative for a list of approved gas generator manufacturers. For the system to work properly and maintain excellent cure rates, the generator should produce at least 50% by weight mixture of air or nitrogen with the **BETACURE® 100** hardener. Ratios of less than 50% produce weaker cores/molds and slower cure times. At extreme conditions, high air volumes can dry out the sand mass, which results in weak cores or molds.

Curing Mechanism

The methyl formate (MeF) vapor is consumed during the curing process. The resin can only react with a specific amount of MeF; however over-gassing does not hurt the final cure. The actual chemical reaction takes place very quickly. The major criteria for good cores and molds is to distribute enough MeF throughout the core/mold. Under curing results in weak cores, low scratch hardness, and short shelf life. The curing rate is dependent upon the quantity of gas generated in relation to the size of the core/mold, and the configuration.

The curing principle is to bring hardener in contact with the resin and have it dwell in place for at least one second. The vapor should not pass through the sand mass and exit as do the gases (catalysts) for the amine or SO_2 systems. Minimum exit vents should be used with the system in order to assure that the vapor stays in the sand

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mass. In theory, the void volume of the sand mass has to be filled 3 to 4 times in order to introduce enough MeF for complete cure.

System Purging

With the MeF being consumed during the reaction, it may not be necessary to have a lengthy purge. It is recommended to purge the line to the gassing head for a few seconds in order to flush the excess vapor (a flammable mixture) from the line and core box. A short air purge will also help distribute the vapor throughout the core. Large cores will require more purging time in order to distribute the MeF properly. Purge air must be vented to the outside or through emission control equipment as may be required by local, State and Federal regulations. Ventilation must be sufficient to keep employee exposure below the threshold limit value (TLV) for MeF and outside the explosive limits (See Material Safety Data Sheet).

Conditions Affecting Performance

Since the **BETASET PROCESS** is water based, general plant air can be used and high humidity conditions will not change the cure rate, mix life or tensile strengths. Core storage under high humidity conditions is typically not a problem.

As with all chemical systems, sand grain shape and fineness will affect the strength and scratch hardness. The binder level must be increased when using lower quality sands. For instance, Olivine may require 2-3% resin B.O.S.

As mentioned before, under-gassing produces a weaker core or mold with short shelf life. It is important, especially during start ups, to plan on over-gassing and then slowly decrease the amount of MeF. The generator size, venting, core/mold configuration, box seals and gassing head all play an important role in the process.

Core – Mold Strengths

The **BETASET PROCESS** will generally produce enough tensile strength for all but the most intricate cores. At nominal levels of 1.5% resin, the tensile strength will approach 150 psi and scratch hardness of 60 psi out of the core box. The tensile strength and scratch hardness will increase during the casting process because of the thermosetting nature of the chemistry. For increased strength requirements higher resin levels can be used without sacrificing casting quality.

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Refractory Coatings

Any type refractory coating can be used with the **BETASET PROCESS**. If a water based coating is required, it is recommended to use a low penetration version. Proper drying techniques should be employed with any coating.

Pour Off Time

Unlike many of the other cold box systems, the **BETASET PROCESS** is almost completely cured during the gassing stage. Cores and molds can be poured very quickly, if not immediately.

For Emergency Medical Assistance Please Call:
Health & Safety Information Services: 1-866-303-6949

For additional health and safety or regulatory information, call 630-575-5722 or 630-575-5705.

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