Using Slurries To Rebond Molding Sand

IN BRIEF: Slurry rebonding can speed up mulling cycles, and it cuts down the amount of additives lost to the atmosphere as dust. These are two important advantages of slurry rebonding, but there can be problems, and there are limitations, too. They are discussed here.

Rebonding practices in both ferrous and nonferrous foundries are changing due in part to changes involving timing of the mulling cycle and to extensive automation. As a result, interest is growing in adding binders to the batch in the form of a slurry, rather than as several measured additions.

Adding Dry Binders—A number of devices have been developed to add dry bonds automatically. Dry bond measurement, transportation, and introduction into the muller all have been found useful and have justified their existence where labor, time, and accuracy were the prime considerations.

More recently, there has been a rapid acceptance of premixed binders and formulations made to a foundry's specification or to the producers' recommended blend. Justifications of premixing are simplicity of additions and reduced chance for error. Total binder use normally is not changed, and the batch addition, although made on a one-shot basis, is not vastly different from what it is when each item is measured separately.

In the preparation of premixed additives, it is common practice to add water to the blend in a sufficient amount to facilitate handling and reduce dust. Conceivably, the additive containing some water is moved and handled many times.

Slurry Additions—Advent of slurry rebonding of foundry sand can be traced to use in Southern pipe shops and other foundries as early as the 1920s. The mud mill was a common device in which crude, raw clay lumps were reduced to a slurry for rejuvenation of spent sand. The system was practical because the clays used generally were nonswelling.

Later, some automotive foundries and others began using the slurry-rebonding method for their molding sands. Some slurry systems were designed for individual mullers; others were used as cen-
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tral systems. These installations proved to be satisfactory.

Subsequently, many foundrymen have attempted to design their own equipment for the making and distribution of the slurry. The degree of success in such cases hinged on adequacy of equipment and understanding of the limitations of the process.

Reasons for Slurries — Where there is a general understanding of the advantages and limitations, the slurry system can offer savings to certain foundries.

Successful users have claimed that a saving in binder use alone amounts to some 10 to 20% over comparable dry binder methods in which materials are lost to dust arrestors.

Principal savings are to be had, however, from faster and more complete dispersion of premixed additives, elimination of the dry mixing time, and a longer, more effective cooling cycle where employed. Most slurry-bonded sand mixes have a more tempered “feel” when they leave the muller, especially on short mixing cycles.

Sand mulling capacity seldom is adequate in a system. Through use of slurries, all ingredients can be added premixed so that they enter the sand mass rapidly. In effect, slurry additions speed up mixing.

Since materials are in a liquid, there are no dust and no pollution problems in the mixing areas.

At some point in a slurry system, dry additions must be made to the slurry tank. To insure accuracy of the slurry mix, automated additive measuring equipment is desirable. Automation eliminates manpower, makes bulk handling attractive for lowest cost, and keeps all muller lines supplied.

Pumping liquids is simple and the slurries can be measured by meters. Many plants are short of air, and pumps for liquids would use less horsepower.

Past attempts to disperse western bentonite adequately and rapidly in the slurry makeup water were not very successful. This fact may account for the somewhat limited acceptance of slurry rebonding. Efforts on the part of bentonite producers and others to accomplish a more rapid and thorough wetting have been made.

Packaged System—A new sys-

tem, available commercially as a complete package, blends additives before the slurry tank. Dispersion of all additives, including clay, cereals, seacoal, and cellulose, intermixed with one another, makes for rapid and complete slurry make-up without agglomerates. This feature alone assures a slurry of uniform consistency. As far as western bentonite is concerned, a maximum of about 9% is set because of the swelling characteristics of the material. Above 9%, the solution’s viscosity increases rapidly, and pumping becomes difficult.

Southern bentonite and fire clays do not possess this limiting feature and can be used in greater amounts—or as a supplement to the western bentonite where higher clay-water ratios are necessary. Thus, a higher total clay slurry can be made providing a nonswelling clay, such as southern bentonite or fire clay, can supplement the western bentonite above the 9% level. On a dry additive basis, the upper limit is about 40% by weight of western bentonite to the total dry additives.

Although premixing of all additives is essential before the slurry water is added, intensive mixing of these solids with the water also is required. With the packaged slurry system, this mixing comes only during the makeup period because two-thirds of the slurry in the tank remains there even at the makeup time and always is under pump recirculation. There is ample opportunity in “off” periods to drain and clean the tank, if necessary. The input of fresh water for
Slurry makeup is at a point close to the mullers. This feature allows a flashback of the line delivery system each time a slurry tank recharge is made, thus, assuring continuous and positive delivery.

The packaged slurry system assures positive delivery of slurry to remote stations by pump. Provisions are engineered to allow tie-in with any of the existing methods of sand control, such as manual control, timed control, and automatic control for batch or continuous mixing systems. There is a minimum resistance to slurry flow throughout, and moving parts are few and easily reached for maintenance.

Conditions for Success — Each foundry has a different set of conditions. Generally, the slurry system will function successfully if the sand rebonding practice satisfies the following conditions:

1. The amount of water used per batch is no less than three times the total dry additive weight (1,500 U.S. gallon water at 8.3 lb/gal).

2. In the case of dry additives, determine the percentage of western bentonite to the total. If the percentage is in excess of 40%, then determine if a combination of two clays can be used to reduce the western bentonite to the recommended level and substitution of the second clay for the difference. Or determine if the total western bentonite by weight divided by total weight of water exceeds 9%. If it does, can a second clay be substituted for the difference above this limit?

For foundries having automatic control for moisture, it is desirable to use slurry water for both flush and base water. Thus, a balance is established between rebonding and moisture demand since it can be assumed that sand temperature bears some relationship to its degree of burnout. For trim water in the batch cycle, plain water should be used. Slurry water cannot be metered in the normal sense.

In foundries already using a premixed binder, the premix can be used in conjunction with a slurry system. If a binder is provided, the foundry can use it to prepare the premix just prior to recharging of the slurry tank.