IMPROVING THE YIELD DURING THE SAND RECLAMATION PROCESS

In the last decades, reclamation of foundry sands is increasing with the main purpose of reducing the cost of buying new sand and also the cost of disposing the waste foundry sand. For this reason, foundries are looking for sands with good durability to improve the yield during the reclamation process, reduce the dust generation and, attend the new limits issued by the Occupational Safety and Health Administration (OSHA) in the United States and other international control policies program for the exposure of the workers to respirable crystalline silica.

In order to understand the performance of the foundry sand, researches were conducted in the early 1990's and pointed out that natural sands like silica sand, chromite, zircon and olivine have a high rate of breakdown during the foundry process. These type of materials deteriorate due to thermomechanical and thermochemical stresses involved in the casting processes and during reclamation.

Nowadays, several other synthetic materials show up as candidates for replacing the traditional natural sands used in the foundry industry, such as fused alumina, sintered bauxite and ceramic sands, just to mention a few. These are being extensively evaluated in order to quantify the benefits for the foundries in terms of quality, cost and occupational health and safety. Considering the scenario previously presented, the durability of these new alternatives must be taken into consideration and, in summary, sand should maintain its properties the maximum as possible after the reclamation process, such as the grain size distribution and the mineralogical composition, in order to keep the performance similar to a new sand.

Focusing the particularities of the foundry market, Mineração Curimbaba designed CASTBALL, a special corundum ceramic sand with unique properties that allow exceptional benefits in the cores and mold process for metal casting industries. CASTBALL presents high strength and durability, consequently reducing new sand consumption.

CASTBALL presents a superior behavior regarding to attrition and impact resistances, as shown in Figures 1 and 2. Sands evaluated in Figure 1 were tested according to a standard widely used to qualify abrasive grains. A 50g sample of the granular media sized to one screen (between the 40 and 50 meshes) was placed into a ball mill jar with steel balls at high rotation speed during 10 minutes. Afterwards, the sample was taken out of the jar and sieved using the 50 mesh. The results represent the quantity of grains that remained retained on the 50 mesh, that means the grains that maintained the initial condition in terms of size.

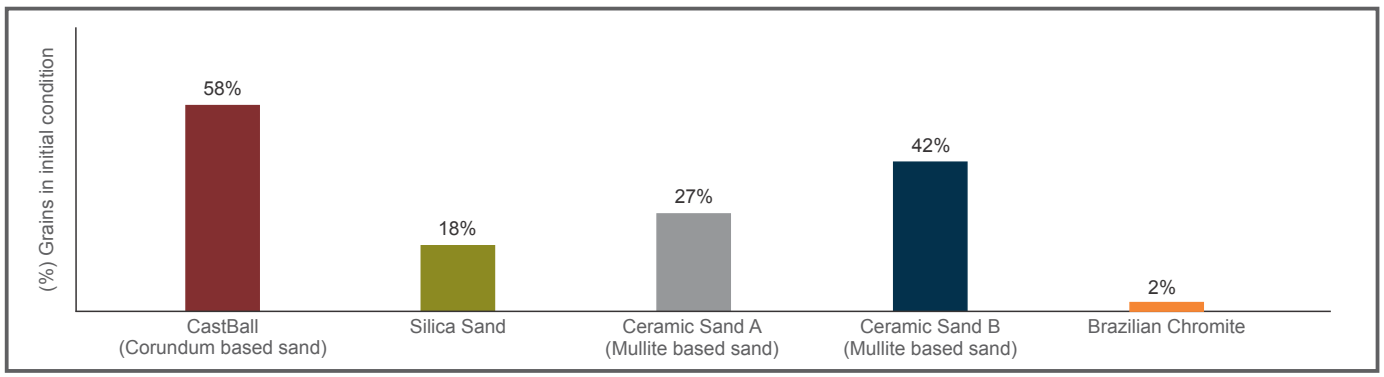

Figure 1 – Results of the attrition tests using a ball mill.

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Figure 2 shows the results of the attrition resistance tests ran by the University of Northern Iowa (UNI). The trials were made using an attrition tester that was designed and developed at the Metal Casting Center of the UNI.

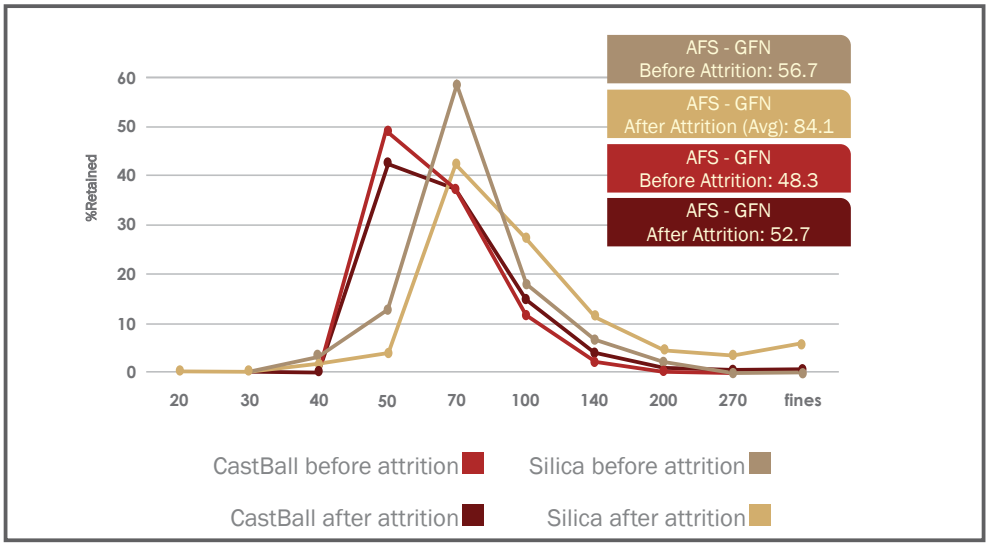

Figure 2 – Results of attrition resistance by the UNI.

In addition to the need of a high attrition and wear resistance, foundry sands are expected to maintain their mineralogical composition after the continuous use (cycles) into the molding process. Mineralogical phases variation can promote burn-on and burn-in defects in the casting. In order to evaluate its behavior, high temperature treatment of the CASTBALL was conducted in a muffle kiln. Figure 3 presents the stability of the CASTBALL in terms of mineralogical composition after three cycles at 1300C per 45 minutes.

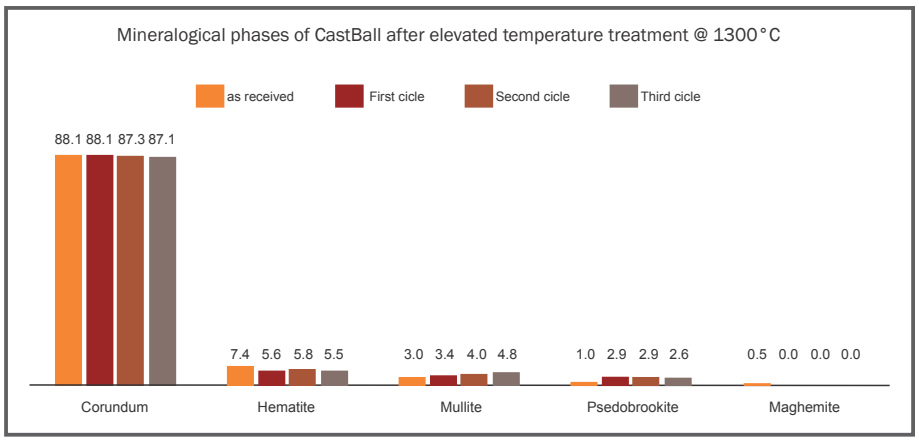

Figure 3 – Results of mineralogical phases change after three cycles at 1300C per 45 minutes.

The high strength and durability of CASTBALL allows the reuse of the sand, increasing the sand reclamation yield and reducing the environmental impact. Consequently, foundries will reduce the cost of buying new sand and also the cost related to the disposal of the waste foundry sand. In addition, foundries will attend the new limits issued by OSHA, since CASTBALL will generate less respirable dust and does not present free crystalline silica in its composition. All these benefits are delivered together with a higher casting surface quality due to the stability of the mineralogical composition.