CASE STUDY

Matrixcote® System

Background

In an effort to improve casting results for a commercial casting foundry, whose existing shell was under performing, Ransom & Randolph tailored the MATRIXCOTE system to improve their casting results. This particular foundry was experiencing significant dewax cracking, positive metal and permeability defects, as well as losing money in scrap and rework. R&R was pleased to provide the foundry with the MATRIXCOTE system customized specifically to meet their needs.

The foundry's existing shell was composed of colloidal silica binder, a fused silica refractory containing carbon and fiber and an alumina silicate stucco. The typical shell sequence required an intermediate coat, 2-3 backup coats (depending on the part) and a seal coat.

The Challenge

Given the casting issues that the foundry was facing, the following goals were identified:

1. Reduce or eliminate dewax cracking. With the existing system, over 50% of the trees going through dewax showed signs of cracking. As a result a post-dewax seal dip was being applied to all trees. This not only increased cost in material usage, but also interrupted the process flow, which created logistical issues as well. Figure 1 shows one of the parts chosen for this measurement.
2. Reduce or eliminate positive metal defects. With the existing system, there were certain part configurations that required nearly 100% rework due to positive metal. Figure 2 shows one of the most challenging parts chosen for this measurement.
3. Increase permeability to reduce or eliminate defects. Figure 3 shows one of the parts chosen for this measurement.
4. Accomplish these goals without adding backup coats to the process. The existing system allowed the foundry to decrease the number of backup dips that they needed previously, by one coat.

The sequence of shell coats was maintained: 2 primary coats (Keycote® binder), 1 intermediate coat, 2-3 backup coats and a seal coat.

Figure 1

Figure 2

Figure 3

Photos from left to right show parts experiencing cracking, positive metal and permeability defects.

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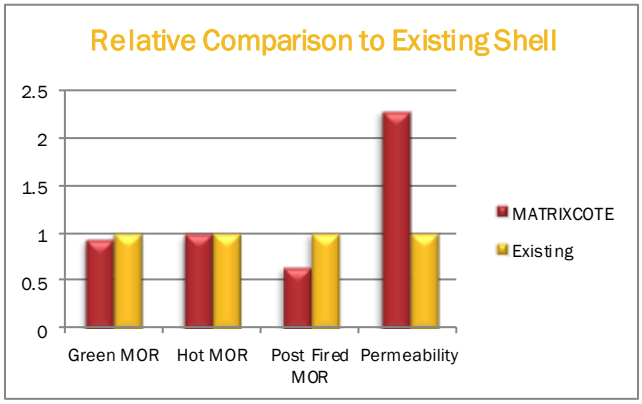
The Trial



The MATRIXCOTE system tailored to meet the challenge was a combination of Matrixsol® 30 colloidal silica, Matrixcote® concentrate with fiber, and Matrixblend® blue refractory with alumina silicate stuccos. MOR data generated in the laboratory indicated that the MATRIXCOTE system had similar green and hot strength to the existing material. Laboratory data comparing the two shells also indicated that post fired strength was reduced by 35% and permeability was increased by 128%.

In the foundry, the MATRIXCOTE system showed promise as indicated with the 2¾ inch round ring part shown in Figure 1. The shell room supervisor noted that the shell made with the MATRIXCOTE system was thinner than their existing shell, but showed cracking on only one ring where the existing shell showed cracking on multiple rings.

Scrap and rework associated with positive metal on parts shown in Figure 2 were decreased significantly after a simple wetting agent adjustment in the intermediate slurry made with the MATRIXCOTE system. Similarly, gas defects previously seen on the parts shown in Figure 3 were eliminated. The foundry moved the MATRIXCOTE system onto one robot system. After consuming all the existing material on the second robot, it also was converted to the MATRIXCOTE system.

Conversion

Conversion to the robots required two minor modifications to slurry viscosity. Both were very easily implemented and the foundry supervisor noted that the slurries have been easy to maintain ever since. The foundry no longer struggles to keep slurries in control and continues to see positive casting results on their parts, including the more difficult-to-cast parts shared in this case study.

The foundry supervisor noted unanticipated operational benefits after conversion as well. These were not identified as original goals for the trial, but are attractive additional advantages.

- Slurry make-up is much faster than the old system. It takes approximately 20 minutes in a high shear mixer set to low speed to make the slurry. Once made, it is ready to use. The old slurry required a more rigid, high-shear protocol and took 60 minutes or more to make.
- Slurry maintenance is very easy. The slurry made with the MATRIXCOTE system is very consistent and hitting the appropriate viscosity target takes little effort. The old slurry seemed to be more temperamental and the foundry never quite got the viscosity target right.

The foundry has been extremely pleased with the results that they continue to achieve with the MATRIXCOTE system and look forward to the lasting success of the system.

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