ALTERNATIVES FOR ZIRCON STUCCO AND FLOUR

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Abstract

Casting trials have shown Itochu Ceratech Cerabeads 60 sand to be a successful substitute for zircon sand in many cases, but not 100% of the time. A new product from Itochu Ceratech, Cerabeads 70, has proven to be a more universal solution as a zircon sand substitute. A zircon flour substitute of alumina and alumino-silicates has been developed and tried in production tests. This slurry in combination with Cerabeads 70 has proven to be successful in replacing zircon in prime layers. Casting trials are presented.

Introduction

The price of zircon flour and sand continues to be high and there are some concerns about long term supply. Many foundries desire a zircon substitute for this reason. This paper is a continuation of a paper presented in 2011 at the Fall ICI Technical Conference. Last year Cerabeads 60 was presented as a potential substitute for zircon sand. While this was true in many cases, there were several instances of rough surface or “burn in” in production trials using standard zircon/fused silica slurry. Presumably, these failures were caused by too thin of a prime coating layer or a reaction of the Cerabeads 60 with the fused silica.

In response to these and other results, Itochu Ceratech developed a new product, Cerabeads 70, which has higher alumina content. Trials using Cerabeads 70 replacing Cerabeads 60 were conducted and some improvement was seen with less instances of “burn in”. Some trials still had “burn-in” using Cerabeads 70, however. In order to have a non-zircon prime slurry and stucco, it became clear that a prime slurry was needed that was not only refractory enough to withstand the molten metal, but that also was capable of leaving a uniform and relatively thick layer of ceramic between the molten metal and the zircon substitute stucco. The slurry presented last year needed to be modified to accomplish this task.

The prime slurry used last year was a blend of Tabular Alumina and Alumino-Silicate flour. This slurry was used to make small crucibles in which we melted metal and evaluated the reaction. The problems with this slurry were that slurry life was shorter than desired and the rheology of the slurry did not provide for the thick inert ceramic layer between the molten metal and the Cerabeads 60 stucco.

Slurry Development

It is well known that the leachable sodium ions in Tabular Alumina shorten the life of a slurry. Low Soda Alumina from Itochu and Almatis were tried in the lab and approved. The Alumino-Silicate from CE Minerals provides lower thermal expansion, is less expensive than alumina, and is not a significant source of leachable ions. When combined with our long life prime slurry binder, Shellbond 824, this slurry is highly stable and suitable for slurry tanks with little slurry turnover.

Stucco

Our zircon substitute stucco is Cerabeads 70. This material offers an excellent combination of size, shape, and refractoriness. Cerabeads 60 can be and is used in some cases and is a little more economical.

Experimental Casting Trials

In order to quickly obtain casting data, it was decided to make small slurries, flow coat or hand pour the trial slurry on a few waxes and stucco with Cerabeads 70 by hand. The risk would be low and a quick read of metalmold reaction could be made. Three foundries graciously agreed to test the slurry and stucco combination.

Trial A – SeaCast – Marysville, WA

Two closed face impellors about 12” in diameter. Both used our test slurry of alumina and alumino-silicate flour named BPF 517. One was stuccoed with zircon and one with Cerabeads 70. Standard process from second dip on was used on both. In the foundry, shell temperature was 1800 F and the metal temperature was 50 F above standard pour temperature (very hot). The alloy was 316 Stainless Steel. See Figure 1 below for a photo of the wax. There were no problems at de-wax. Shell removal was normal. Casting surfaces looked normal. See Figures 2 and 3 for pictures of castings.

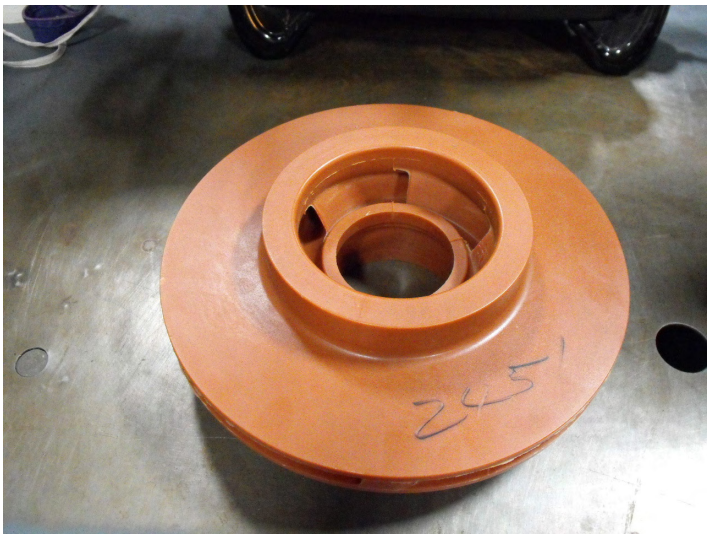

Figure 1. Wax part used in trial at SeaCast.

Figure 2. Casting using BPF 517 and Zircon Stucco on prime.

Figure 3. Casting using BPF 517 and Cerabeads 70 stucco on prime.

Results of Trial A: Excellent indication that the chemistry of the slurry and stucco is correct given the large amount of metal and high pour temperature. Further trials are warranted.

Trial B – Fenico - Paramount, CA

Two different trees were shelled both using BPF 517 and Cerabeads 70 stucco. See Figures below for pictures of waxes. The tree on the right will be cast in 304 SS and the one on the right in 4140 steel.

Trial C – Highland Lakes – Marble Falls, TX
(This trial is scheduled, but not started yet.)

Conclusions:

The SeaCast trial was very encouraging. It is too early to draw conclusions. Additional data will be available by convention time. Additional trials with other alloys including vacuum cast alloys are needed. Only visual inspection data has been gathered. Shrink data is needed from penetrant and x-ray.