Overcoming Common Wax Injection Problems: The First Step Toward Automation

Recycling of Pattern Waxes

Member Profile: Westech Wax Products

New Face Coat Material for Molds
The shell is an extremely important part of the casting process. All ceramic shell molds are built up from three different components: the binders (generally colloidal silica or ethyl silicate), a refractory “flour” filler (with both being applied as a slurry) and a coarse refractory sand (called “stucco”). Zircon has been widely used (flour and stucco) for the face coat, mainly due to its temperature inertness and stability. But, the use of zircon as a face coat has a few critical drawbacks, which are gradually pushing investment casting foundries to consider alternative materials.

The main source for zircon is heavy mineral sands that are mined during titania production (for which zircon is a by-product/co-product). Zircon has been subject to irregular supply and availability issues resulting in significant price increases, at times. The other drawback is the radioactivity of molding waste, as zircon tends to contain radioactive isotopes of uranium and thorium. Besides potential health-related issues, the radioactivity in zircon may also increase waste disposal costs.

Finally, zircon also has some technical disadvantages. It contains mineralogical impurities (rutile, apatite, ilmenite, and even rare earth phosphates). These additional impurities are unavoidably added during extraction and processing and may lead to foundry defects, as they decrease the thermal stability of zircon (even when present at extremely low levels).

**Fused Aluminas as Alternative Synthetic Minerals**

The best known alternative materials to zircon are various fused aluminas. These are manufactured by melting pure calcined alumina in an arc furnace at about 2050°C/3722°F. From a mineralogical point of view it is then alpha-Al2O3 (corundum). This material is further transformed into adapted products for various different applications, through particular melting, cooling, and milling processes, as well as by special separation and sorting procedures. The major advantages of fused alumina are minimal variation of impurities, and the possibility to choose between a large variety of particle sizes and shapes for optimal fitness for use.

The first generation of fused alumina products is being widely used as face coat material in investment casting of super-alloys. However, shell removal problems has been experienced in Steel Casting, due to vitrification and absorption of alloying constituents, such as Cr, Mn, etc. (Figure 2)

**Modified Fused Alumina, Treibacher Alodur WRG IC ESR: A New Generation of Products**

Specially modified fused alumina (WRG IC ESR) exhibits outstanding properties, when it comes to heat resistance and chemical stability. These properties allow casters to avoid vitrification and migration of alloying elements into the ceramic mold. (Figure 3) Furthermore, its high heat and deformation resistance (Figure 4) is one key element to producing castings with extremely tight tolerances (for e.g. turbo charger wheels).

Another key advantage of modified fused alumina is its
excellent compatibility with standard Na-stabilized binders. Even after 10 months test-runs, slurries show no signs of changes in optical, pH, or viscosity values. (Figure 5)

The lack of natural impurities and variations, especially in face coat materials (Figure 6), is definitely one of the biggest advantages of this new primary coat generation. Use of this material allows for irregular appearance of defects in castings to be reduced to a minimum.

This combination of positive properties (almost impurity free, due to being synthetic, and high thermal/chemical stability) leads to outstanding foundry results. Of particular relevance, WRG IC ESR slurry allows significant improvements in the production of very complex pieces that are traditionally suffering of high reject rate. In this case, defects and further (previously necessary) finishing works (due to use of unstable raw materials) can be considerably reduced. (Figure 7)