Improved downsprues for Lost Foam castings

Capital Refractories Ltd, established for over 40 years and represented in over 30 countries, has supplied ceramic fibre pouring bushes and cups to the Lost Foam Industry for over 12 years. Capital Refractories prides itself on working closely with its customers to develop improved products. The company has a strong service team and technical back up resource in the UK, Europe and around the world.

In comparison with downsprues formed by foam, resin bonded sand or other materials, ceramic fibre pouring cups and downsprues have been conclusively proven to:
- Reduce sand inclusion
- Reduce carbon pick up
- Reduce heat loss due to foam burn
- Increase insulation
- Reduce costs due to scrap
- Reduce costs of consumables
- Negate issues of controlling sand level

Problems with standard ceramic fibre

For many years downsprues formed from standard vacuum formed ceramic fibre have been used by casters operating the Lost Foam process. However, the more demanding processes among Lost Foam applications have revealed deficiencies in the standard ceramic fibre products. Standard ceramic fibre is a versatile and resilient material but, in comparison with later developments, it is weaker and more brittle. The combination of high metal velocity, high pressure, high volume throughput and high temperature usually associated with the Lost Foam process often causes severe erosion, fibre inclusion and sometimes metal leakage in applications using standard ceramic fibre.

Super Ceramic Fibre

Following requests from castings producers to develop a more wear resistant alternative to standard ceramic fibre, Capital Refractories Ltd’s standard fibre mix was developed to give it increased strength and wear resistance. These properties were achieved with the correct selection and grading of appropriate refractory fillers, special binders and superior fibre selection and blending. The manufacturing process was also refined to give improved consistency and tolerance. For over 10 years, this Super Ceramic Fibre has, time and again, proven a far superior performance than standard ceramic fibre or alternate sprue forming methods to resist erosion and penetration.

It is interesting to note that, since its introduction, the application of the Super Ceramic Fibre has not been restricted to only the most demanding of processes; the relentless battle by castings producers to improve quality and reduce scrap rates has increased focus on the performance of feeder materials in virtually all applications.

Case studies

Capital Refractories’ customers include Saint Gobain Pipelines, GSL and Lovink Turborg. Below are outlined a few short case studies to illustrate the advantages of Super Ceramic Fibre.

Strength

During investigations to improve quality by this iron caster it was discovered that erosion of the ceramic fibre downspur wall was taking place. Shotblasting the metal sprues revealed penetration running within the ceramic fibre wall. Development by the producer to densify and harden the ceramic fibre material, partly by the use of refractory fillers, totally eliminated the problem allowing the caster to achieve reductions in the scrap rate from 7 – 2%.

Tolerance

Another company found that downsprues made from standard ceramic fibre were not able to meet their requirements for size and tolerance. Although vacuum formed ceramic fibre products are not a machined component, the particular characteristics of Super Ceramic Fibre and the special manufacturing process allow the producer to specify a tolerance of ±2mm/1mm. In some applications, tolerance can be further tightened by the use of gauge collars; in these cases a tolerance of ±0mm/1mm is achievable.

Size

Some Lost Foam producers have had difficulties procuring downsprues to their required length. With correct material selection, sprue design, mould design and refined handling techniques it is now possible to produce much longer ceramic fibre spars than has been the case. Depending on outlet diameters, lengths of 2m are possible; flanged connectors allow lengths in excess of 2m to be assembled.

Use of refractory fillers, improved binders and fibre selection has improved surface strengths. The capability of ceramic fibre feeding is illustrated by its successful application for the most demanding of feeding applications such as steel pouring as well as, in the case of one of Capital Refractories’ customers, feeding of a 9t non-ferrous billet.

Cost

A company that casts steel components with the Lost Foam process previously used foam sprues. It suffered from sand inclusion, carbon pick up and heat loss. Super Ceramic Fibre has been successfully proven to improve quality, but what is more, this company was able to reduce its consumable costs.

Capital Refractories also provides a number of non-ceramic fibre alternatives in situations where Health & Safety may be considered an issue.

The company

Over the last 50 years, Capital Refractories has manufactured and supplied a high quality range of refractory and ancillary products for ferrous and non-ferrous foundry and precision investment casting applications. Capital Refractories has supplied ceramic fibre pouring bushes and cups to the Lost Foam Industry for over 12 years. The company offers a world wide service with offices or representation in over 30 countries within Europe, the Far East, North America and South America.

The company has a strong service team and technical back up resource and prides itself on working closely with its customers not only to provide technical support and customer service but also to work hand in hand to develop improved products. The company’s aim is to reduce foundry operational costs with high quality refractory products.

Capital Refractories Ltd is an ISO9001:1994 registered company.

Reader Reply No.19
Solution for sand compaction

Fata Aluminium, manufacturer of Lost Foam casting equipment since 1980, continues to play a pivotal role in this section of the foundry industry and is recognised as an international leader in this field.

Lost Foam casting line at Telksid - Carmagnola, Torino, Italy to meet the European requirement for engine block and cylinder head manufacture. This brings the total number of Fata Lost Foam casting lines at this operation to four.

**Casting line operation**

Fata Aluminium’s casting lines are fully automated requiring only two labourers to operate. One is responsible for the cluster loading operation placing the coated clusters onto a cluster loading indexing turntable. From this stage, the cluster is automatically picked up by a robot and accurately held in the pouring flask for compaction. After compaction, metal is automatically poured into a pouring cup or basin positioned over the cluster downsprue. The pouring flasks are automatically indexed through the cooling stations. After the product has cooled, it is automatically extracted or dumped. Upon extraction from the pouring flasks, and subsequent water quenching, if necessary, the second operator is responsible for casting cluster removal and degating. Degated castings are delivered downstream for post processing operations. Sand from the pouring flasks is delivered to a sand reconditioning system and reintroduced into production after cooling.

**Compaction table**

One of the most critical aspects of the Lost Foam process is compacting the sand and filling the internal channels of the evaporative polystyrene (EPS) models and, at the same time, preventing any distortion and/or deformation of the casting clusters. As a result of the Lost Foam process to produce increasingly complex castings with a multitude of multidirectional internal passages, optimising the compaction process is important. Fata Aluminium, through many hours of research and development has concluded that a vertical vibrating system is the best solution.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
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<tbody>
<tr>
<td>Pre-expanders</td>
<td>10 – 50kg/h for evaporative bead preparation</td>
</tr>
<tr>
<td>Lost foam tooling</td>
<td>Mat based tooling required for moulding and gluing of the polystyrene patterns</td>
</tr>
<tr>
<td>Pattern moulding machines</td>
<td>Vertical or horizontal configuration, standard or custom designs</td>
</tr>
<tr>
<td>Pattern assembly machines</td>
<td>Pneumatically and hydraulically operated, standard or custom designs</td>
</tr>
<tr>
<td>Cluster assembly machines</td>
<td>High throughput automated assembly equipment</td>
</tr>
<tr>
<td>Coating systems</td>
<td>Fully integrated robotic dipping station for refractory application, transfer manipulator and drying ovens</td>
</tr>
<tr>
<td>Cast line</td>
<td>Fully automated casting cell including cluster pre loading carousel, automatic pouring flask loading and unloading, multiple sand filling and compaction station for high throughput</td>
</tr>
<tr>
<td>Sand systems</td>
<td>Complete sand cooling and delivery systems</td>
</tr>
<tr>
<td>Post processing equipment</td>
<td>Automated cluster extraction manipulators, degating devices; pre machining, cleaning and test equipment</td>
</tr>
<tr>
<td>Thermal sand regeneration</td>
<td>Automated system with throughput of up to 12t/h to remove accumulated polystyrene deposits from the sand</td>
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Fata Aluminium supplies turnkey systems or offers individual components to support the production of lost foam castings. This table shows a list of the equipment required.