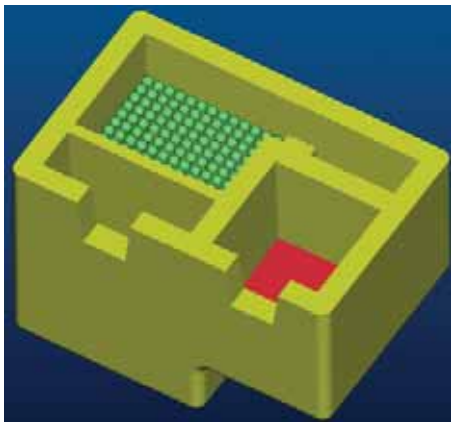
Filtration of molten aluminium with a three-stage chamber system using a final-stage cyclone

John Courtenay and Michael Bryant* describe a new three-chamber filtration system incorporating a unique feature, a final-stage of cyclone filtration, which is undergoing evaluation trials in a casthouse at Trimet Aluminium, Germany.



1 Design of the XC filter

There is a general feeling within the aluminium casthouse industry that there is a need to develop an efficient, low-hold-up volume, filtration process capable of treating high flow metal rates. Ceramic foam filters have the advantage of single heat use, low floor space and low-hold-up volume, but their relatively small dimensions and high metal velocity through the filter contribute to relatively low filtration efficiency. Deep-bed filters can be used for multiple casts and are large enough to contain the amount of filter media necessary to process thousands of tonnes of aluminium with excellent filtration efficiency but at the expense of high metal hold-up volume and high floor space requirement.

The aim of the current project was to develop a filter that would combine the attributes of ceramic filters with the attributes of deep bed filters and would therefore be able to deliver high filtration efficiency but with low hold up volume, low floor space requirement and the ability to be used economically in conjunction with frequent alloy changes.

Review of published work

A key element in the approach to the project, was the reported phenomena, by Towsey *et al* (1,2,3), of enhanced filtration efficiency in ceramic foam filters that could be achieved by adding the grain refiner post filter. Grain refiners added before fine ceramic foam filters reduced filtration efficiency by preventing bridge formation and suppressing cake filtration.

The same effect had also been reported in relation to the operation of porous tube filters by Kakimoto *et al* (4). In these filters, bridges of calcium oxide particles which tend to form at the pores at the surface of a tube filter, as an essential step prior to formation of a stable filter cake, were also suppressed by the prior addition of boron-containing grain refiners.

In 2005, Instone *et al* (5,6) described a new design of filter unit named the XC filter which gave superior filtration efficiency achieved by the combination of ceramic foam filtration and deep bed filtration. Importantly, this design comprised a three- chamber unit with a ceramic foam filter in the first chamber, grain refiner addition in the second chamber and a small bed filter in the third chamber as shown in Fig1.

LimCa performance data from extensive industrial casting trials with the XC Filter showed that excellent filtration efficiency could be achieved. However, in the current project, it was decided, in addition to employing the principle of adding grain refiner in a second chamber after a ceramic foam filter, to concentrate on developing an alternative to the third-chamber bed filter, as used in the XC Filter, in order to simplify the operation and maintenance of the unit.

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