

## New 'green' technologies make die castings stronger

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Conventional die castings can be made stronger using new, more environmentally friendly technologies developed by CSIRO.

The two new technologies - a dynamic gating system and the 'ATM runner system' - produce high-integrity castings with fine-grained <u>microstructure</u> and low porosity by improving the feed of molten metal into the casting. Both systems are suitable for use with aluminium and magnesium alloys.

"This is accomplished by influencing the flow behaviour of the molten metal, the fill pattern of the die, and subsequent solidification," says the leader of CSIRO's research team of metallurgists and casting engineers, Dr Rob O'Donnell.

"Our researchers realised that by changing the way in which molten metal is delivered to the die we could take advantage of the high pressure inherent in the process to make castings with finer microstructure and lower porosity," Dr O'Donnell says.

The researchers achieved higher quality castings by changing the architecture of the runners (the passages along which molten metal flows into the die) and the gate (the narrow opening to the die cavity).

"Our improved melt delivery systems are cost-effective, can be used with existing casting machines, and can significantly reduce the mass of the metal runner, wasting less metal.



"They represent new 'green' die casting technologies, which are lowenergy and highly effective."

Gases captured during the passage of the <u>molten metal</u> into the die cavity cause porosity, which together with voids created during solidification, reduces the quality of the casting.

Die castings with low porosity are stronger and can be successfully heat treated post-casting to improve their mechanical properties.

The dynamic gating system (DGS) incorporates a gate capable of changing its size in response to the pressure of the melt during filling. X-ray analysis of test castings showed a significant improvement in density in both thicker and thinner areas of the casting, when the dynamic gate was used.

A paper describing the dynamic gating system received the best paper award at the North American Die Casting Association (NADCA) CastExpo10 congress, held in March in Orlando, Florida.

A reviewer of the paper commended the CSIRO researchers for producing a technology with "real-world" relevance to high pressure die casting, saying "This is a technology that has significant promise in the future of our industry".

ATM technology uses a revolutionary melt delivery system for the high pressure die casting (HPDC) process, which is cheaper to operate than conventional HPDC.

The ATM casting technology has been proven by a number of companies in commercial production, and its effectiveness in reducing both shot weight and reject rates has been demonstrated.



"ATM conditions the melt prior to filling the cavity so that the melt enters the die in a less viscous, 'runnier' state," Dr O'Donnell said.

"As a result, melt flow is improved and separate melt fronts fuse together better when they meet within the casting."

The outcome is a casting with a more uniform distribution of nucleation sites, a refined, homogenous microstructure, and exceptionally low porosity.

## Provided by CSIRO

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