

Structural components with Vacuum Technology in HPDC, LPDC and Gravity Die-Casting

Author: Lorenzo Valente, Tiziano Valente - ECOTRE, Brescia, Italy

ABSTRACT

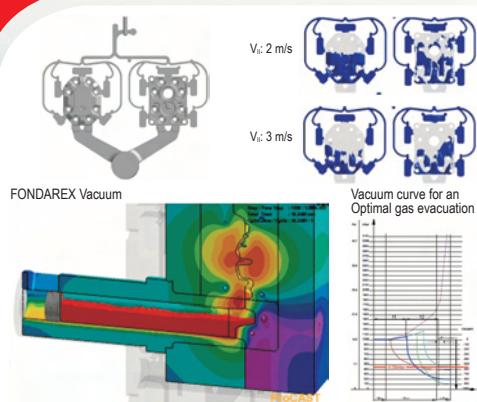
OEM and automotive market is driving foundry suppliers to high performance castings: high structural integrity, high mechanical properties, welding and heat treatment. These requirements are typically obtained with gravity and low pressure die-casting, but are more expensive than hpdc. HPDC need Heat Treatment T6 or special Al alloy to increase mechanical properties. In case of T6, gas porosity inside the component goes on surface forming blisters during solubilization treatment at 520°C for 8 hour. Gas porosity decrease component performances. In case of special alloys, they have high viscosity due to low Si with unfilling cavity.

Today, the right technology to obtain structural components in HPDC is the Vacuum. Vacuum solves gas porosity and gas counterpressure.

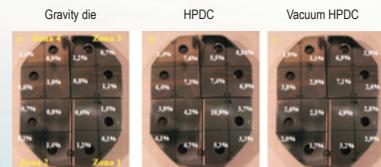
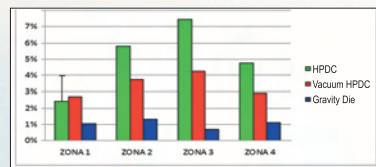
FONDAREX and Vacural are "State of art" in the market (Ref. Sistemi sottovuoto per la pressocollata in camera fredda di getti ad alta integrità strutturale ed alte prestazioni - I. Todaro - L. Tomesani - Bologna University). This activity will demonstrate how to obtain an HPDC with T6 or with a special low Si alloy.

There are also new important improvements in Low Pressure and Gravity Die Casting. In fact, market need to reduce weight thanks to minor thickness. These processes have some limitations on minimum thickness due to unfilling cavity. In this case Vacuum would like to eliminate gas and air counterpressure to completely fill cavities. This work will show some industrial application with vacuum also in LPDC e Gravity die.

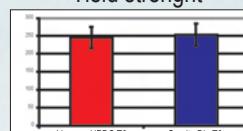
To obtain high mechanical performances HPDC need Heat Treatment T6: vacuum to eliminate porosity



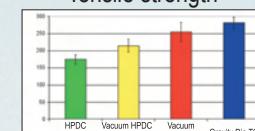
% average gas porosity: process benchmark



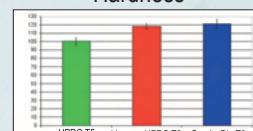
Yield strength



Tensile strength

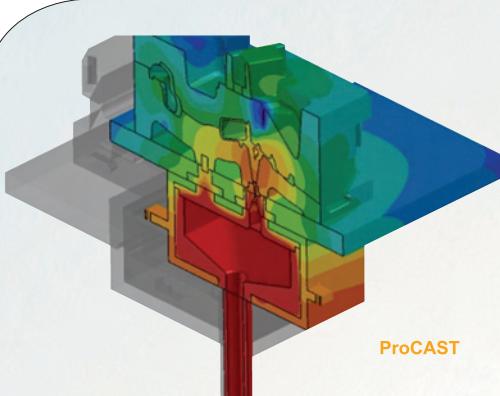


Hardness



M. MANZOLI, L. TOMESANI, R. SQUATRITO, E. REBECCCHINI, L. CESCHINI, A. MORRI, Convegno Nazionale AIM 2010

To obtain low weight LPDC need thin thickness: vacuum to eliminate gas counterpressure

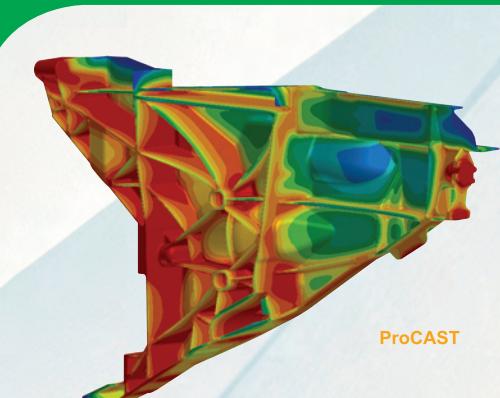


PROJECT MIUR "2mm" (Part 1 of 2) – Project Goal

Weight reduction and mechanical properties increase for automotive structural components cast in light metal alloy in Gravity Die Casting and LPDC.

Aim of the project is to produce automotive structural components for space frame with thickness reduced from 4 to 2mm by the use of innovative low pressure and gravity die casting plants and dies with vacuum, real time monitoring and closed loop logic management. Research and tuning of an optimal aluminum alloy suitable both for gravity die casting and LPDC. Casting simulations will define alloy composition, component design, gating and evacuation system, heating die, process parameters and best fitting equipment.

To obtain low weight Gravity Die Casting need thin thickness: vacuum to eliminate gas counterpressure



PROJECT MIUR "2mm" (Part 2 of 2) – Component Goal

- Weight reduction through thickness reduction till 2mm. The reduced thickness generates a major geometrical and gas counterpressure, increasing filling time and promoting misruns. Vacuum removes gas counterpressure.

- Increase of mechanical properties: Yield strength, Tensile strength and elongation.
- Reduce amount of inclusions, oxides, micro-shrinkage that can affect fatigue life tests and that can't be detected through standard X-ray analysis
- Reduce micro shrinkage porosity dimensions below threshold of mechanical fracture, evaluating shape, dimension and localization of porosity thanks to casting simulation software
- Transfer of casting simulation results into FEM structural analysis software of customer for component design

Courtesy of:



Project MIUR "2mm" realized by:



ecotre
TECNOLOGIE D'AVANGUARDIA
Specialista di processo