國立虎尾科技大學

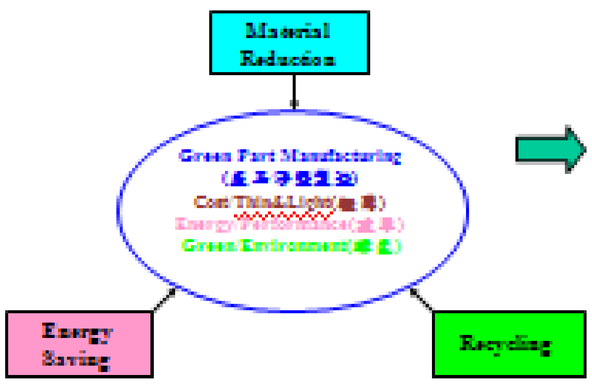
淨型製造技術在高功率LED散熱結構製作之研發與應用

發明人:周榮源

技術內容

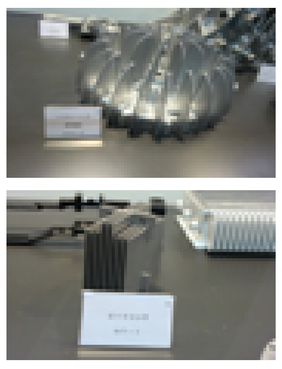
Net Shape Forming Technology - High Vacuum Die Casting (HVDC)

國內獨立研發完成
具薄件量產之新技術



提高功能性
提高可成形性或強度
提高可焊接性

Advantages of Vacuum Die Casting:
- Vacuum produces cleaner looking castings with less lube stains.
- Vacuum can eliminate cold lap surface defects.
- Vacuum reduces need for overflow pockets.
- Vacuum reduces need for high pressures and so enables larger parts or more impressions per given machine size.
- Vacuum enables the die designer to address gating conundrums.
- Vacuum eliminates blister defects in painted and polished parts.
- Vacuum increases process yield.
- Higher yield means the die live to make more orders.
- Vacuum reduces the load on inspection personnel, by producing good parts more consistently.
- Vacuum can enable parts to be made thinner.
- Castings made with vacuum are stronger.
- Vacuum made parts make clients content.



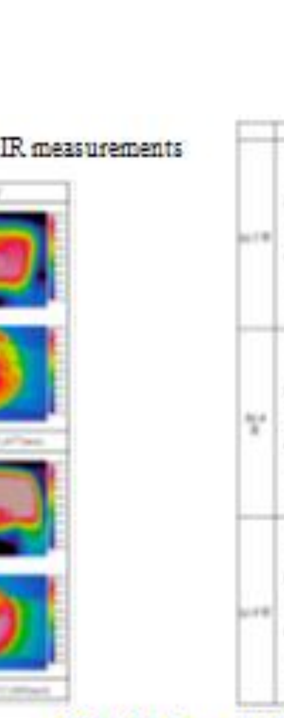
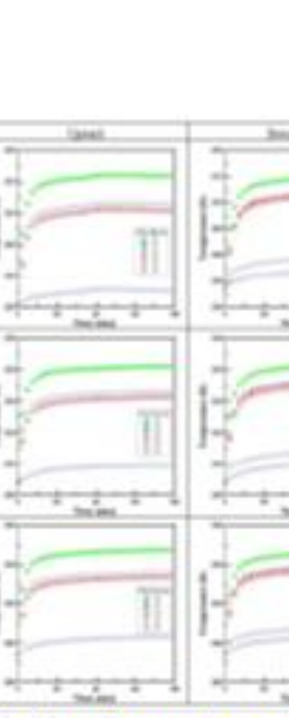
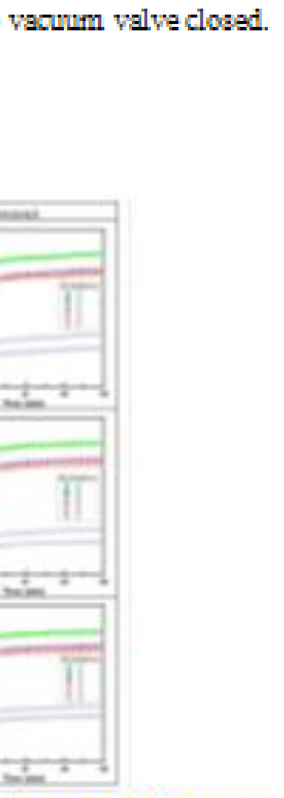
Al vacuum die-casting examples: LED lamps and heat sinks (source: 2010 Japan Die Casting Show) (提高功能性：高散熱能力、輕量化)

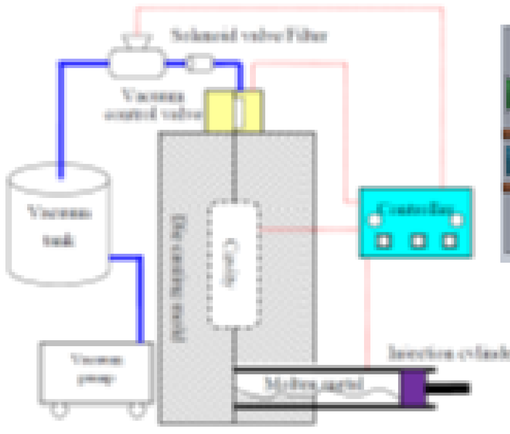
Al vacuum die-casting examples: Auto part and motorcycle frame (source: 2010 Japan Die Casting Show) (提高可焊接性)

Al vacuum die-casting examples: Auto parts and pneumatic hand tool parts (source: 2010 Japan Die Casting Show) (提高可成形性或強度)

The high vacuum die casting process is effective to reduce the porosity (5.47% increment in weight) and to increase the strength (4.83% increment in maximum stress) of the investigated specimen.

Fig. Specimen tensile testing: (a) atmosphere casting; (b) vacuum casting

Method	Vacural method	Multi-stage vacuum method	Controlled filling (CF) method
Company	MÜLLER WEINGARTEN AG (Germany)	Pfeiffer Vacuum GmbH (Germany)	Yamaha (Japan)
Characteristics	This is another valve-on-die method that sucks metal from the furnace into the shot sleeve. It allows for the reliable production of highly elastic structural and chassis components; thin-walled, weldable chassis components; and castable surface parts.	In the new 'Vacu' multi-stage vacuum process, the shot sleeve and mold cavity are evacuated in two stages. During the first stage, the air is extracted directly from the shot sleeve via a wide cross-section line. In the second evacuation stage, the air is extracted directly from the mold, as in the case of conventional processes. The second stage serves to maintain the pressure by pumping down air that leaks into the mold.	Characterized by (1) seals inserted between mold sections to increase vacuum completeness, (2) stabilization of the molten aluminum temperature by controlling mold temperature, (3) improved injection speed for the molten aluminum.
System configuration			



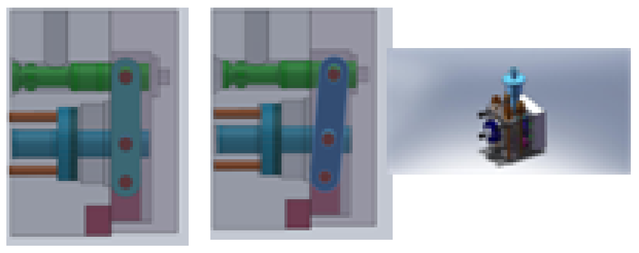


Fig. (a) Schematic of high-vacuum die casting (HVDC) system; (b) vacuum valve opened; (c) vacuum valve closed.

LED Heat Sink Designs:

1. *Passive Cooling Technology*:
   - (1) Extrusion Heat Sink
   - (2) *Die-casting Heat Sink*
   - (3) Ceramic Heat Sink
   - (4) Stamping Heat Sink

2. *Active Cooling Technology*:
   - (1) Nuventix SynJet (Philips)
   - (2) Heat Pipes
   - (3) others

Fig. Surface temperatures of the LED heat sink by IR measurements

Functions	Specifications
LED performance	1.Substrate temperature≦85°C (LED power≧9W) ; 2.Illumination flux≧13500lux
HVDC manufacturing	1.ADC12 by Toyo BD-250V2CW (vacuum pressure≦10Torr) 2.Fin thickness≦0.6mm 3.Weight reduction≧40% (dimension=φ65x33mm) 4.Tensile strength≧400kg 5.Meet the requirements of GPM

LED heat dissipation structure with very thin of fin thickness (≦ 0.6mm)

Fig. The aluminum LED heat sink manufactured by the HVDC process

聯絡窗口：國立虎尾科技大學 智財技轉組 王偉儒
聯絡電話：05-6315561
網址：http://nfu-test.eipm.com.tw/index.asp