Research on the Improvement of Soundness AG40A Zinc Alloy Casting

鄭嘉慶、胡瑞峰

E-mail: 9511329@mail.dyu.edu.tw

ABSTRACT

The defects of zinc alloy die-castings often happen due to its characters and the fast die-casting sped. This research was main mainly focus on the resolution of solving those defects in the AG40A zinc sanitary die-casting. The different designs of casting established by the CAE and the real castings by the hot chamber die-casting will be compared to reveal the optimal process used for the AG40A zinc alloy die-castings. The process parameters considered in this research include the casting pressure, the pouring temperature and the mold temperature of die. Utilizing the CAE simulation software FLOW-3D to simulate the different project of the AG40A zinc alloy will realize the flow filling and the solidification process. The distribution and position of gas porosity in the AG40A zinc alloy casting will be analyzed through the simulation of FLOW-3D for the different gating systems. The result show that the correspondence of the simulation of CAE and the practical die-castings. In addition, the vent hole and the overflow design will be suitable for decreasing the defects of AG40A zinc alloy die-castings.

Keywords : AG40A zinc alloy ; computer-aided engineering ; hot chamber die casting ; porosity ; cold shut

Table of Contents

REFERENCES

[1] 林惠娟、黃振東、鄭憲清, "鑄造程式之電腦模擬-ProCAST 應用實例介紹", 鑄造月 刊第77期, pp.20-48, 中華民國八十五年二月 [2] 葉俊麟, "模擬分析於鑄造製程技術之應用", 金屬工業35卷第1期, pp.40-47, 中華民國九十年一月 [3] 莊水旺、王志名, "CAE模流軟體在壓鑄模具設計之應用", 工業材料174期, pp.113-117, 中華民國九十年六月 [4] ZHANG Weishan, XIONG Shoumei and LIU Baicheng, "Study on a CAD/CAE system of die casting," Journal of Materials Processing Technology 63, pp.707-711. (1997) [5] Flow-3D User ’s Manual, Lecture2: Hands On Session, Flow Science Inc. pp.104-110. (2004) [6] 黃文星, "電腦在鑄造上的應用", 鑄造月刊第47期, pp.37-39, 中華民國八十五年二月 [7] B.H Hu, K.K. Tong, X.P. Niu, I. Pinwill, "Design and optimization of runner and gating systems for the die casting of thin-walled

magnesium telecommunication parts through numerical simulation," Journal of Materials Processing Technology, pp.465-468. (2003) [8] 劉明凌, "鋁合金壓鑄輪圈之流動系統設計及分析", 中央大學機械工程研究所碩士 論文, pp.9-11, 中華民國九十三年六月 [9] 莊水旺、張又中, "應用CAE技術於壓鑄模流道形狀對空氣袋形成之影響研究", 模具 技術成果暨論文集, pp.49-55, 中華民國九十四年七月 [10] Gotz C. Hartmann, Vloker Kokot, Rudolf Seefeldt, "Numerical optimization of casting processes-leveraging coupled process simulation and multi-object optimization to the manufacturing level," International Congress on FEM Technology. (2003) [11] Shuhua Yue, Guoxiang Wang, Fei Yei, Yinin Wang, Jiangbo Yang, "Application of an integrated CAD/CAE/CAM system for die casting dies," Journal of Materials Processing Technology, Vol.139, pp.465-468. (2003) [12] W.B. Lee, H.Y. Lu, Y.B. Lui, "A computer simulation of the effect of wall thickness on the metal flow in die casting dies," Journal of Materials Processing Technology Vol.52, pp.248-269. (1995) [13] ASM Metals Handbook, "Nonferrous alloys and special-purpose materials," Vol.2, 10th, pp.528-535. (1990) [14] R. W. Bruner, "The metallurgy of die casting," Society of Die Casting. (1986) [15] 林煜昆, "全國壓鑄工廠及資材廠商名錄", pp.92-93, 中華民國七十六年七月 [16] ASTM B240-01, "Standard specification for zinc and zinc-aluminum (ZA) alloys in ingot form for foundry and die castings," Vol.02.04. (2001) [17] ASM Metals Handbook, "Metallography, structures and phase diagrams," Vol.8, p.265. (1973) [18] H. Ogura, "Casting shrinkage of thin walled castings" Journal of Dentistry, Vol.23, No4, pp.239-244. (1995) [19] 香港壓鑄學會, "未來壓鑄軟件趨向", 學會通訊第4期, 中華民國九十年十月 [20] 林煜昆, "壓鑄技術實務", 徐氏基金會出版, pp.115-118 , 中華民國八十二年 三月 [21] E.A. Herman, "Die casting dies: designing," Society of Die Casting Engineers Inc, pp.16-17. (1990) [22] 彭世寶、黃文淵, "模具學(五)", 科友圖書有限公司, pp.18-22, 中華民國七 十七年十二月 [23] 香港金屬工會, "鋅壓鑄熱流道的設計及應用", 中華民國九十一年三月 [24] Donald F. Young, Bruce R. Munson, Theodore H. Okiishi, "Fundamentals of fluid mechanics," John Wiley & Sons. p.20. (1994) [25] 張晉昌, "鑄造學", 全華科技圖書有限公司, pp394-396, 中華民國八十一年四月 [26] T. G. Groeneveld and A. L. Ponikvar, “ Designing for thin-wall zinc die castings ” , International Lead Zinc Research Organization, Inc., pp.25-46. (1986) [27] 鍾尚浩, "鑄造灌模及凝固解析模式之改良及其相關實驗技術之研究發展", 成功 大學礦冶及材料科學研究所博士論文, 中華民國八十年六月 [28] A.S. Sabau and Viswanathan, "Micro porosity prediction in aluminum alloy castings," Metallurgical and Materials Transactions B:, Vol.33, No2, pp.243-255. (2002) [29] T. S. Piwonka and M. C. Flemings, "Pore formation in solidification," Trans. of the Metall. Soc. of AIME, Vol. 236, Aug., p.1157. (1966) [30] E. Niyama, T. Uchida, M. Morikawa and S. Saito, "A method of shrinkage prediction and its application to steel casting practice," 49th International Foundry Congress, Apri., p.1. (1982) [31] 張瑞模, "鑄造中氣孔、渣孔、縮孔鑄庇之缺陷及其改善對策", 鑄造科技161期, pp.14-20, (2003) [32] T. S. Piwonka and M. C. Flemings, "Pore formation in dolidification, "AFS Transactions, Vol.236, pp.55-157. (1996) [33] Serope Talpakjian, "Manufacturing engineering and technology , " 3th Edition, , pp.313-315. (1995) [34] W. G. Walkington, "Die casting defect: causes and solutions," North American Die Casting Association, pp.18-22. (1997) [35] 唐乃光, "壓鑄模具設計手冊", 金屬工業研究發展中心, pp.80-96, 中華民國 八十七年十月 [36] Mervin T. Rowley, "International atlas of casting defects" AFS Trans, pp.167-169. (1974) [37] Len. Estrin, "A deeper look at casting solidification software," Modern Casting, Vol.84, pp.23-24. (1994) [38] W.S. Hwang and A. Stoehr, "Computer simulation for the filling of castings," AFS Transactions, Vol. 95, pp.87-141. (1987) [39] 林逸啟, "滴管在不同壓力函數下之流場分析", 中原大學機械工程研究所碩士 論文, pp.18-20, 中華民國九十年七月 [40] 施忠易, "壓鑄鋅合金件之電腦模擬分析和表面缺陷研究", 大葉大學機械工程 研究所碩士論文, 中華民國九十四年六月 [41] 謝楷模, "AG40A鋁合金砂車蹄片之鑄造模擬分析", 大葉大學機械工程研究所 碩士論文, 中華民國九十四年六月