Announcement on the 10th FOSECO Cup for Excellent Foundry Papers (2007)

The final evaluation of the 10th FOSECO Cup for Excellent Foundry Papers (2007) organized by Foundry Institution of Chinese Mechanical Engineering Society (FICMES) was carried out on July 21–24, 2008 in Guiyang, Guizhou province.

More than 1,500 papers were widely selected in this activity, which were published in various journals during 2007 including FOUNDRY, CHINA FOUNDRY, Special Casting & Nonferrous Alloys, Modern Cast Iron, Foundry Technology, Foundry Equipment Research, China Foundry Machinery & Technology and Foundry Engineering, and those published in the proceedings of academic congress organized by FICMES, each of the technical committees of FICMES, or all the provincial and municipal foundry institutes in the year of 2007.

After the first stage of evaluation, 70 papers in total were selected to enter into the second stage of evaluation (final evaluation). Through the deliberate evaluation, ten silver award papers, three honorable award papers and two gold award papers were selected out. The 55 remaining papers were recommended as excellent papers.

The Excellent Foundry Paper Evaluation Committee of FICMES
July 2008

The gold award papers

1. Tensile Properties of Al Sheet at Elevated Temperature for Pressure Can Prepared by Different Melt–treatment Methods

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Abstract: Effects of different melt–treatment methods on tensile properties and microstructure at elevated temperatures of the Al sheet for pressure cans have been investigated using optical microscope (OM), differential thermal analysis (DTA), scanning electron microscope (SEM), X–ray energy diffraction analysis (EDAX) and transmission electron microscope (TEM) based on tensile testing at elevated temperatures. The results show that the existence of metallurgical defects can restrain the high temperature deformability and directly affect the crack propagation in the aluminum sheet as the key crack resource. Compared with the conventional treatment, the high–efficient melt–treatment can remarkably improve the metallurgical quality and uniformity of high temperature deformation, greatly raising the high temperature plasticity due to transgranular micro–pore gathering crack mode. The high temperature plasticity of high–efficient melt–treated aluminum sheet would be greatly deteriorated as a result of the coarsened grain size and creation of FeSi phase when the deformation temperature is more than 500°C, so the proper deformation temperature should be chosen in the range of 400–450°C. The main plastic deformation properties of the aluminum sheet from lower grade commercially pure aluminum after high–efficient melt–treatment can reach or exceed the properties of the aluminum being used, which shows the availability of lower grade aluminum raw materials.

Key words: aluminum; melt–treatment; tensile properties at high temperature; mechanical properties; microstructure

Published in Special Casting & Nonferrous Alloys journal, No.6, 2007
Professor Fu Gaosheng, born in 1965, graduated from Fuzhou University and obtained his B.S. degree in Foundry in July 1984, his M. S. degree from Shanghai Jiaotong University in March 1993, his Ph.D from Central South University of Technology (now Central South University) in March 2000. He is currently professor and advisor to doctoral candidates, a known scholar at higher colleges and universities of Fujian province. His research interests mainly focus on the structures and properties of high performance metal materials, melt treatment techniques of non-ferrous alloy and its strengthening and toughening, mechanical behavior of the materials deformation, material forming technique, etc. He was with responsibility for and completed over 10 projects supported by the Natural Science Fund of Fujian Province and by grants from Fujian Provincial Planning Projects on Science and Technology, over 10 development projects committed by enterprises, and nearly 10 projects supported by Fujian provincial testing fund for higher colleges and universities and by science & technology development fund from Fuzhou University. His researches have won Fujian Provincial Award for Advancement in Science and Technology (second place), Fujian Provincial Invention Awards (gold and silver medals). All of these researches have led to the publication of more than 100 technical papers, of which seven were included in Thomoson ISI’s list of SCI, 27 in the list Elsevier Engineering Information. Twelve graduates supervised by him have obtained their M. S. degree, two graduates with their Ph.D. He is currently an adviser to two doctoral candidates and seven graduates being pursuing their M.S. degrees.

2. Study on Interfacial Heat Transfer Coefficient at Metal/Die Interface during High Pressure Die Casting Process of AZ91D Alloy

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Abstract: The high pressure die casting (HPDC) process is one of the fastest growing and most efficient methods for the production of complex shape castings of magnesium and aluminum alloys in today’s manufacturing industry. In this study, a high pressure die casting experiment using AZ91D magnesium alloy was conducted, and the temperature profiles inside the die were measured. By using a computer program based on solving the inverse heat problem, the metal/die interfacial heat transfer coefficient (IHTC) was calculated and studied. The results show that the IHTC between the metal and die increases right after the liquid metal is brought into the cavity by the plunger, and decreases as the solidification process of the liquid metal proceeds until the liquid metal is completely solidified, when the IHTC tends to be stable. The interfacial heat transfer coefficient shows different characteristics under different casting wall thicknesses and varies with the change of solidification behavior.

Key words: high pressure die casting (HPDC); magnesium alloy; interfacial heat transfer coefficient (IHTC)

Published in CHINA FOUNDRY journal, No. 1, 2007

Born in 1981, Mr. Guo Zhipeng graduated from the Tsinghua University in 2004 with a bachelor degree in Mechanical Engineering and now he is continuing his study there as a doctoral candidate. His research mainly focuses on the metal/die interfacial heat transfer behavior during the high pressure die casting (HPDC) process, which has a great influence on the solidification process and the mechanical properties of die castings. Based on systematic die casting experiments, Guo Zhipeng has been studying the interfacial heat transfer behavior during the HPDC process thoroughly, and achieved a comprehensive understanding about the influence of the process parameters, casting alloys and casting thickness on the heat transfer. By now his 14 papers have been published based on his work and 10 of them have been cited by SCI. The study was financially supported by the National Natural Science Foundation of China, National Basic Research Program of China, Toyo Machinery & Metal Co., Ltd., Korean Institute of Industrial Technology and Ford Motor Company.
The honorable award papers

1. Solidification of Ductile Iron
Zhou Jiyang
Published in Proceedings of the China Foundry Week 2007 of FICMES, October 2007

2. Main Points of Die Casting Process and Die Casting Die Design
Pan Xianzeng, Liu Xingfu
(1. MG Technology (Shen zhen) Co., Ltd. of Ka Shui Holdings Co., Ltd., Shenzhen 518111, China; 2. FAW Foundry Co., Ltd., Foundry Mould Plant, Changchun 130011, China)
Abstract: The die casting machine, die and alloy, the three on the basis of die castings, and running through with the die casting process forms organically a whole and an effective system. Making the machines well to mate with dies, optimization of die casting construction, optimization of selecting die casting machine, optimization of die design and improving the flexibility of die casting process (operational point), thus all of these provide a secure guaranty for production. So to say the process conveys in the die, this has a profound intension.
Key words: die casting machine; die; die casting process; die design
Published in FOUNDRY journal, No. 5–9, 2007

3. Several Considerations on Dust Control Standard for Foundry (GB8959–2007)
Lu Zheming1, Song Gaojü2
(1. Shanghai Institute of Mechanical & Electrical Engineering Co., Ltd., Shanghai 200402, China; 2. No.6 Institute of Project Planning & Research of Machinery Industry, Zhengzhou 450007, China)
Abstract: The dust control standard for foundry has been parsed briefly by analyzing and summarizing the significance, staring point, contents, development process and present conditions of foundry dust control technology to help the users to understand it completely and use it correctly.
Key words: casting; dust control; standard; analysis
Published in Proceedings of the 1st Meeting of the 8th Annual Meeting of Environment Protection and Safety Technology Committee of FICMES, November 2007

The silver award papers

1. DN2600 Ductile Iron Pipes Making Technology
Chen Jinlei, Yan Guodong, Li Zhaozhui, Wang Zhigang, Jia Qingbo, Gu Yanmei, Kong Guobin
(Xinxing Ductile Iron Pipes Co., Ltd., Handan 056300, Hebei, China)
Abstract: Through studying the manufacturing technology of DN2600 ductile iron pipes, the characteristic and difficulty of DN2600 ductile iron pipes in die making and production technology were clarified, which supplied the technical instructions for mass production of DN2600 ductile iron pipes.
Key words: centrifugal casting ductile iron pipe; die making; production technology; defect prevention
Published in FOUNDRY journal, No. 2, 2007

2. Discussion on Some Technical Problems of Resin-Coated Sands for Shell Mould Casting
Jin Yongxi, Wang Yiqian
(Shanghai Santman Foundry Co., Ltd., Shanghai 201805, China)
Abstract: Based on the more than 10 years’ experience of running shell mould casting line and the application of various resin coated sands, some technical problems of resin coated sands for shell mould castings were discussed. A detailed introduction was made to such aspects as the properties of the wet coated sand suitable for multi–station shell mould shooting machine, the development of a sort of high strength coated sand with low resin content, the shaping index and wetness adjusting process, analysis and prevention of peel back defect of shells made with overturning hopper process, test method of peel back resistance of coated sand, as well as pinhole defect analysis of high Ni ductile iron shell mould castings and application of anti–pinhole coated sand.
Key words: shell mould casting; coated sand; technical problem
Published in Modern Cast Iron journal, No. 1, 2007
3. A Study on Melting Technique of HT300–Grade High Strength Gray Iron for Cylinder Blocks and Heads

Pang Wei
(Foundry Co., Ltd., China First Automobile Group, Changchun 130062, China)

Abstract: The influences of melting process, carbon and silicon, manganese and sulphur, alloying and inoculation on molten iron quality of high strength gray irons were analyzed. It is considered that using pig iron in large fraction would increase shrinkage tendency of the molten iron and decrease properties of castings, and selection of carburizing agent is the key of melting with full steel scrap charge. It is necessary, in order to produce high strength gray iron castings with relatively high carbon and silicon content, to take measures to increase graphite nuclei in the melting process and, at the same time, increase sulphur content to prevent the graphite from growing into coarse flakes; proper alloying and inoculation can obviously decrease the shrinkage tendency of the molten iron. It was pointed out that, by delaying knock out to let castings slowly cool in moulds, it is possible to eliminate casting stress and to offer the last guarantee for producing high quality castings.

Key words: high strength gray iron; cylinder block and head; quality of molten iron; carburizing agent

4. Control of Reinforced Particles Distribution in SiCp/Al Composites Using High Magnetic Fields

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(1. Key Laboratory of National Education Ministry for Electromagnetic Processing of Materials, Northeastern University, Shenyang 110004, China; 2. School of Materials and Metallurgy, Northeastern University, Shenyang 110004, China)

Abstract: In order to investigate the effects of high magnetic fields on the distribution of SiC particles in Al matrix and on the interface between SiC and matrix, solidification experiments of low–fraction SiC particle reinforced aluminum matrix composites were conducted under various magnetic field conditions. The results show that reinforced particles distribute homogeneously under uniform magnetic fields due to the convection suppression effect of Lorenz force. Furthermore, the behavior of reinforced particles can be controlled by selecting magnetic parameters such as intensity and direction of gradient magnetic fields. High magnetic fields also contribute to developing interface by inhibiting interface reaction and good interface formation is obtained in the experiments when Al–Si alloy is used as matrix in the composites.

Key words: composites; high magnetic fields; interface; particle–reinforcement; electromagnetic processing of materials

5. Refining Mechanism of the Electric Current Pulse on the Solidification Structure of Pure Aluminum

Liao Xiliang
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Abstract: The refining mechanism of the electric current pulse (ECP) on the solidification structure of pure aluminum is systematically investigated by properly designed experiments. The experiment results show that the solidification structure cannot be refined by exerting an ECP on the high temperature liquid phase, indicating that the ECP has no inoculation effect on the liquid metal. The ECP has also no obvious influence on the solidification structure when it is applied during crystal growth, showing that the ECP cannot cause melting or break off the growing crystal. However, the very fine macrostructure is obtained by applying an ECP during the nucleation of the melt. The reason is that the ECP makes the crystal nuclei formed on the wall of the mould fall off and move freely in the molten metal, promoting the multiplication of crystal nuclei.

Key words: solidification; pulse current; microstruature; mechanism; refining

Published in Acta Materialia journal, Vol 55, No. 9, 2007

6. An Improved Sodium Silicate Binder Modified by Ultra–Fine Powder Materials

Wang Jina¹, Fan Zitian¹, Wang Huafang², Dong Xuanpu¹, Huang Naiyu¹
(1. State Key Laboratory of Plastic Simulation and Die & Mold Technology, Huazhong University of Science and Technology, Wuhan 430074, P. R. China; 2. Wuhan Library of Chinese Academy of Science, Wuhan 430074, P. R. China)
Abstract: This paper presents a new method of modifying sodium silicate binder with ultra-fine powders. The sodium silicate binder modified by ultra-fine powder A and the organic B can reduce the addition amount of the binder. The results indicate that the 24 h strength has increased by 39.9% at room temperature and the residual strength has decreased by 30.7% at 800 ℃, compared to the conventional sodium silicate. An available material to improve the moisture resistance was also found by adding about 2% more inorganic C, and it can increase the moist strength by 20%. In the end, the microanalyses are given to explain the modifying mechanism, i.e., the ultra-fine powder A can refine the sodium silicate binder to avoid holes in the binder bond, which can increase the 24 h strength at room temperature, and can lead to more cracks in the bond after the molding sand is heated to 800 ℃. This is because of the stress caused by the new eutectic complex of modified sodium silicate binder.

Key words: sodium silicate binder modification; ultra-fine powder materials; bonding strength; moisture resistance; collapsibility

Published in CHINA FOUNDRY journal, No.1, 2007

7. Review of Reclamation of Used Green Molding Sand
Yu Zhenzong
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Abstract: Reclamation of used green sand is to decrease consumption of raw sand and discharge of waste sand. Simple reclamation method is applied in some foundries to reduce the clay content of used sand therefore keep the clay content of molding sand stable. While in other foundries which produce multi–core castings, to reduce the overflow of used sand, the used sand, after deeply reclaimed, is used to prepare resin bonded core sand instead of raw sand. The used sand which containing sodium bentonite can not be reclaimed by high temperature roasting, otherwise, it is unsuitable for hot–box and cold–box sand core.

Key words: reclamation of used sand; clay content of molding sand; shell core; hot-box core; cold-box core

Published in Foundry Engineering journal, No. 3, 2007

8. Study on Technology of Multifunctional Counter Gravity Casting Equipment
Li Xinlei, Hao Qitang, Li Qiang, Jie Wanqi
(School of Materials science and engineering, Northwestern Polytechnical University, Xi'an 710072, Shaanxi, China)

Abstract: Counter gravity casting equipment (CGCE), such as low pressure casting (LPC), counter pressure casting (CPC) and adjusted pressure casting (APC) equipment, have been extensive used in practice. However, most of the equipment has the single function. In this study, the technology of multi–functional counter gravity casting equipment (MCGCE) is developed, which can perform LPC, CPC, APC. Some key technologies, such as structure design of the main part of equipment, multifunctional pneumatic control system, electric control system, and development of high performance digital assembled valve and control software have been studied. The practice application proved that the MCGCE not only meets the needs of multi–production and research in different casting type, but also has the advantages, such as high pressure control precision and safe operation.

Key words: low pressure casting; counter pressure casting; adjusted pressure casting; multifunction; counter gravity casting equipment

Published in FOUNDRY journal, No. 7, 2007

9. Recycle and Reutilization of Foundry Wastes
Yu Yonglai, Ma Shunlong, He Mingbi
(FAW Foundry Co., Ltd., Changchun 130062, China)

Abstract: Taking ferroalloy casting production as example, the source of the wastes such as sand, slag, dust, exhaust gas and so on and their harmful influence on environment was analyzed in details. It was believed that it is necessary to consider the comprehensive utilization of the wastes during building a new foundry or tech–reformation of a foundry, and it was pointed out that this job should be carried out by improving project design, applying advanced equipment, using clean production processes, and applying new treating technique of wastes resource. At last, the experience of FAW Foundry Co., Ltd., in recycling and reutilizing above mentioned wastes was introduced.

Key words: foundry; wastes; recycle; reutilization

Published in Modern Cast Iron journal, No. 3, 2007

Kang Yonglin, Wang Zhaohui

(School of Materials Science and Engineering, State Key Laboratory for Advanced Metals and Materials, University of Science and Technology Beijing, Beijing, China)

Abstract: The SiC nano–particle reinforced AM60 magnesium alloys were fabricated by the semi–solid process. The effects of SiC nano–particles on microstructure and mechanical properties of AM60 alloy have been investigated using optical microscope, Brinell hardness tester and MTS material testing machines etc. The results reveal that the microstructure and mechanical properties of the AM60 magnesium alloy can be improved with the addition of SiC particles. With 1% SiC nano–particles addition, the optimized mechanical properties of the alloy can be obtained, whose yield strength, tensile strength and elongation are improved by 56.9%, 19.2% and 69.3% respectively, and whose hardness and impact energy are increased by 16.4% and 18.8%, respectively, compared with those of the original alloy. The mechanism of strengthening and toughening of magnesium alloys containing SiC nano–particles is also approached.

Key words: magnesium alloy; SiC nano–particles; semi–solid, microstructure; mechanical properties

Published in Special Casting & Nonferrous Alloys journal, No. 8, 2007

The excellent papers

2. Study and Application of Cu–Mn Alloyed As–Cast Ductile Iron (Zhou Wei, Xu Wanli, Guo Zhiying)
3. Foundry Technology and Theory based on Non–Newtonian Fluid (Xing Shuming, Bao Peiwei, Liu Wen)
4. Study and Practice of Decreasing Residual Stress with Residual Heat of Casting (Tong Siyi)
7. Investigation and Application of Air–Hardening Bainitic Cast Steel Free from Molybdenum and Nickel (Fu Hanguang, et al)
9. Study on Metallographic Techniques for Cast Mg Alloy (Huo Liang, Han Zhiqiang, Liu Baicheng)
10. A New Method of Improving the Properties of Nodular Cast Iron (Qi Kai, Wang Zixin, Li Tingjü, Sun Meiqin)
11. Microstructure and Wear–Resisting Properties of 2Cr13 Stainless Steel Strengthened by In–Situ TiC Dispersion (Wu Qianlin, et al)
15. Casting Technology of Gray Iron Cylinder Block and Head for Medium–Small Vehicle Engine (Kang Kuanzi)
17. Machinability of Isothermally Quenched (Austempered) Ductile Iron (Jincheng Liu)
18. Effect of Ester Additions on Curing Rate and Strength of Precoated Sand (Liang Chunyong, Li Haipeng, Wang Wanglei)
19. Microstructure and Properties of AZ91D Magnesium Alloy by Vacuum Die Casting (Fu Penghuai, Zhai Chunquan, Jiang Haiyan)
20. Optimization and Control of Triethylamine Cold–box Core Making Technology (Qu Zhibi, Ji Zuming)
21. Optimal Design of Blast Wheel in Wheel Blasting Machine (Xu Jinhong)
22. Development and Application of XZ42 Series Horizontal Parting Flaskless Shoot and Squeeze Molding Line (Chen Qiaohua)
23. Research and Application of Lost Foam Casting Technology for Engine Cylinder Block & Cylinder Head (Wang Xinjie)
25. Analysis on the Invalidation of the Vane of Blast Wheel (Jiang Qinghe)
26. The Selection of Molding Equipment and Automatic Line in Foundry Plant Reforming of Medium and Small-sized Enterprises (Jia Ying)
27. FEA Modeling and Analysis of Die Casting Machine for Large Mg Alloy (Zhang Xiaofeng, Zeng Pan, Lei Liping)
28. Casting of Component with Steel Shell and Al Core by Soaking in Heat Al Liquid (Xiao Yunhong, Wang Xiaoming, Wang Xuechao)
29. Development Trend and Demands for Castings of Wind Power Station (Li Chuanshi)
30. Study on the Mechanism of Stress Corrosion in Magnesium Alloy Based on Electronic Theory (Zhang Guoying, Zhang Hui, et al)
32. About Steel Casting Quality (Cai Linghua)
34. Study on Mechanical Properties of Vacuum Die-cast AZ91D Magnesium Alloy (Hu Bo, Xiong Shoumei, et al)
36. A New Technique for Preparation of Semi–solid A356 Aluminum Alloy Slurry (Pei Sheng, Mao Weimin, Yang Xiaorong)
37. Technological Design of Gating System as Riser for the As–cast Iron Crank Casting of Oil Extracting Pump (Lian Wei, et al)
38. Study on Investment–Sand Mold Compound Casting Technology of a Large Complicated Stainless Steel Impeller (Yang Bingbing, Fan Zhikang, Chen Shuhui)
40. Variation of Liquid Composition and Its Effects on Relative Rayleigh Number during Solidification of Two Kinds of Ni–Cr–Co Based Super alloys (Wang Ling, Dong Jianxin, Zhang Maicang, Zheng Lei)
41. Synthetical Evaluation on Characteristic Parameters of Internal Cavity in Die Castings by Using Fuzzy Mathematics (He Xijie, Zhang Caixia, Zhangyong)
43. The Three–body Abrasive Wear Resistance of WC Particles Reinforced Steel Matrix Composites (Li Xiubing, Fangliang, et al)
44. Study of Purification and Spheroidization of Heavy Section RE–Mg Ductile Iron in Powder Injection Process (Wang Liping, Li Dayong, et al)
45. Numerical Simulation on Air Distribution in Bag–filter (Zhao Jingxia, Shen Henggen, et al)
46. Composite Preparation and Rheocasting of Semi–solid Aluminum Alloy Slurry (Mao Weimin, Tang Guoxing, Bai Yuelong)
47. Microstructure and Properties of AZ91D Magnesium Alloy in Combination Process of Die Casting with Forging (Li Yuanfa, Li Qing, Luo Shoujing)
48. Effects of TiC Particles on As–cast Microstructure, Mechanical Properties and Solidification Behavior of ZA84 Magnesium Alloy (Yang Mingbo, Pan Fusheng, Baille)
49. Metallographic Etch for Cast AZ91D Magnesium Alloy (Fu Zhennan, Xiong Shoumei)
50. Interface Morphology and Microstructure Evolution of Cu–0.5Cr Alloy in Directional Solidification (Li Xiaoli, Li Jinshan, Hu Rui)
51. Effects of Ag Microalloying on Heat–resistant Properties of Al–Cu–Mg–Mn–(Zr,Ti) Alloy (Xiao Daihong, Song Wen, Chen Kanghua)
52. Rapidly Solidified Zr–based Alloy by Shock–wave Quenching (Yang Chao, Chen Weiping, Wang Wenkui)
54. New Super–high Strength Aluminum Alloy by Horizontal Continuous Casting under Low–frequency Electromagnet (Zuo Yubo, Cui Jianzhong, Zhao Zhihao)
55. Effects of Sb on Microstructure and Mechanical Properties of Mg–4Al–2Si Alloy (Song Peiwei, Guo Xuefeng, Jing Xiaotian)