The 13th "FOSECO Cup" Excellent Foundry Papers Released

The Excellent Foundry Paper Awards are presented annually by Foundry Institution of Chinese Mechanical Engineering Society (FICMES), and this year the final evaluation activity of the 13th "FOSECO Cup" for Excellent Foundry Papers (2010) was carried out in Xining City, Xinjiang Uyghur Autonomous Region of China between July 20–24, 2011.

As usual, the entries were those papers published in various journals during 2010 including *Foundry*, *China Foundry*, *Special Casting & Nonferrous Alloys*, *Modern Cast Iron*, *Foundry Technology*, *Foundry Equipment and Technology*, *China Foundry Machinery & Technology* and *Foundry Engineering*, and those published in the proceedings of academic congresses organized by FICMES, each of the technical committees of FICMES, or all the provincial or municipal foundry societies in the year of 2010.

The judging panel is made up of 24 experienced and respected figures in FICMES and its technical committees, provincial or municipal foundry societies, and the chief-editors of above journals. Prof. Su Guoxiong from Southeast University chaired the panel. Finally, two of the seventy-two (72) entries won the gold awards; they are the paper titled "Advanced Manufacturing Technologies of Large Martensitic Stainless Steel Castings with Ultra Low Carbon and High Cleanliness", authored by Lou Yanchun, et al. of Shenyang Research Institute of Foundry and published in the 11th issue of *Foundry*, and the paper "The mystery of molten metal" by Natalia Sobczak, et al. of Foundry Research Institute, Cracow, Poland and published in the 4th issue of *China Foundry*. One special award paper was recognized this year, and the honor went to Yu Zhenzong, who has contributed to the research on green sand the whole life. The paper is titled "Test Technique of Green Sand Properties" and serially published in the 1th–5th issues of *Modern Cast Iron*. In addition, ten silver award papers were recognized, and the 59 remaining papers were recommended as excellent papers.

The recipient of the awards will be honored at the China Foundry Week 2011, which will run in November in Guangzhou, China.

Special award paper

Test Technique of Green Sand Properties

Yu Zhenzong
(Machinery Engineering Department of Tsinghua University, Beijing 100084, China)

Abstract: The national standards and industrial standards, as well as the up to date detection instruments on performances and raw materials' quality of green sand were systematically presented. Some techniques on performance testing of green sand were presented, and some opinions were put forward concerning about the corresponding test method and instruments abroad. This serial paper includes two parts, i.e. "Testing technology for green sand performances" and "Test method for the quality of raw materials of green sand". The first part covers the test methods on sampling method, test of moisture content, compactness, permeability, green strength, etc. While the second part focuses on the criterion and testing technology of the green sand raw materials.

Key words: green sand; test method; raw materials
Published in *Modern Cast Iron*, 2010(1–5)

Gold award papers

1. Advanced Manufacturing Technologies of Large Martensitic Stainless Steel Castings with Ultra Low Carbon and High Cleanliness

Lou Yanchun, Zhang Zhongqiu and Xiong Yunlong
(Shenyang Research Institute of Foundry, Shenyang 110022, China)

Abstract: The key manufacturing technologies associated with composition, microstructure, mechanical properties, casting quality and key process control for large martensitic stainless steel castings are involved in this paper. The achievements fully satisfied the technical requirements for the large 700 MW stainless steel hydraulic turbine runner of the Three Gorges Hydropower Station, and become the major technical support for the design and manufacture of largest 700 MW Hydraulic Turbine Generator Unit in the world developed through our own efforts. The characteristics of a new high yield ratio and high obdurability martensitic stainless steel with ultra low carbon and high cleanliness are also described. Over the next ten years, the large martensitic stainless steel castings and advanced manufacturing technologies will see a huge demand in clean energy industry such as nuclear power, hydraulic power at home and abroad. Therefore, the new high yield ratio and high obdurability martensitic stainless steel materials, the fast and flexible manufacturing technologies of large size castings, and new environment friendly sustainable process will face new challenges and opportunities.

Key words: large martensitic stainless steel castings; ultra low carbon and high cleanliness; turbine runner and blade
Published in *Foundry* journal, 2010(11)

About the author

Lou Yanchun, born in 1963, Ph.D, Eng., researcher. He gained his Ph.D from China Academy of Machinery Science and Technology in 2006. He is now the President of Shenyang Research Institute of Foundry, and he also serves as the Director of Chinese Mechanical Engineering Society (CMES), and Chief Commissioner of the National Technical Committee 54 on Foundry of Standardization Administration of China.

He has devoted himself to the R&D for foundry materials, casting technology and equipment, and their engineering application for many years. His research work has won him many awards including two National Prizes for Progress in Science and Technology (both in second place), four Provincial and Ministerial Science & Technology Awards, one Excellent Award of China Patent. By now, he holds six invention patents, and has published over 30 technical papers.

He put forward the double refining process, i.e. secondary refining + electroslag remelting, by which the clean liquid steel with high quality can be obtained. This broke the bottleneck in development of castings for large size hydraulic turbine. He developed a high efficient and environmentally friendly technology that using water cooled copper mould replaces the sand mould to achieve a rapid sequential solidification, and obtained the large size stainless steel castings with good surface quality, high dimensional accuracy, compact internal structure and good comprehensive performance. He also developed the key technology of step control of the phase transformation during heat treatment, thereby the crack problem of large size martensitic stainless steel that caused by both the thermal stress and transformation stress was solved. It has been applied successfully in over 20 large projects, such as Ertan Hydropower Station Construction Project, Three Gorges Project, etc.

2. The mystery of molten metal

Natalia Sobczak, Jerzy Sobczak, Rajiv Asthana, Robert purgert
(1. Foundry Research Institute, 30-418 Cracow, Poland; 2. Department of Engineering & Technology, University of Wisconsin-Stout, Menomonie, WI 54751, USA; 3. Energy Industries of Ohio, Cleveland, OH 44131, USA)

Abstract: Recent advances in scientifi c understanding of high-temperature materials processing using novel experimental methodologies have shed light on the complex role of surface and interface phenomena. New in-situ studies on molten metal/solid ceramic interactions using a unique experimental complex at the Foundry Research Institute, Krakow, have revealed a number of unusual observations in materials processing at high temperatures. We present some such unusual observations and their explanation with reference to liquid metal processing of Al, Ni, and Ti, and their alloys in contact with oxide ceramics. In particular, we focus on the following aspects: primary oxidation of Al from residual water vapor or oxygen, capillary purification to remove surface oxide, substrate protection by CVD carbon, roughening due to spinel whisker formation, inclusions in castings due to mechanical detachment, fl oatation due to buoyancy forces, and segregation due to directional solidifi cation, modifi cation of the solid surface morphology by metal vapor ahead of the liquid, and the complication due to multi-component alloys melted in crucibles made from complex oxide-based ceramics. In the case of Ti, rapid reactions with oxides result in undesirable volumetric changes that create diffi culty in casting high-quality Ti parts, particularly by investment casting. Nanoscale (e.g., colloidal) coatings based on Y_2O_3 protect crucibles and hold ladles against such attack. Practical insights and recommendations for materials processing emerging from the fundamental studies on hightemperature interfacial phenomena have been described.

Key words: molten metal; high-temperature phenomena; in-situ observation; casting defects
Published in *China Foundry* journal, 2010(4)

About the author

Natalia Sobczak, born in 1956, Prof., DSc, Ph.D, PI. Specialist in the field of high temperature liquid state materials science, composite synthesis and joining dissimilar materials by liquid-assisted processes, casting of advanced and specialty materials. Head of the Center for High Temperature Studies at the Foundry Research Institute (Cracow) and Scientific Adviser at the Motor Transport Institute (Warsaw). She received her MSci and Ph.D degrees from St Petersburg State Polytechnic University and DSc from the Polish Academy of Sciences. Visiting professor at University of Wisconsin-Milwaukee (1994-1996), Hokkaido University (2000), Osaka University (2000-2001), University of Wisconsin-Stout (2002), Institute for Energetics and Interphases IENICNR in Genova (2007, 2008, 2009). Head of Section 8.1. Cast Composites of Word Foundry Organization (since 2001). Member of Polish Foundrymen Association, Polish Society of Composite Materials, Polish Society for Materials Science, ASM. Winner of numerous national and international awards including Gold Medal Award of Polish Foundrymen's Association, Third Prize at Int. Metall. Contest, IMS & ASM, First Prize Award of Polish Agency for Enterprise Development in the category "Polish Product of the Future", Award of Polish Academy of Sciences for young scientists, Awards from Polish Ministry of Industry for Innovative products, Silver Medal at Salon Int. des Inventions in Geneva, Gold and Bronze Medals of the Belgian Chamber for Innovation, Brussels Expo. Author and co-author of 4 books, more then 200 papers and 14 patents.