Present State of Japanese Casting Industry in 2012

September 22nd, 2012
Japan Foundry Society, Inc.
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1. Great East Japan Earthquake and its influence on Japanese foundry industry
2. Cope with an energy problem
3. Strong yen
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5. New initiatives of Japan Foundry Society, Inc.
## 1-1) Great East Japan Earthquake

<table>
<thead>
<tr>
<th>Earthquake type</th>
<th>Inter-plate earthquake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake size</td>
<td>9.0-magnitude (It is the 4th scale in the history of the world.)</td>
</tr>
<tr>
<td>Main damage factor</td>
<td>Severe earthquake and tsunami</td>
</tr>
<tr>
<td>Number of death &amp; Missing person</td>
<td>Death: 15,840 people</td>
</tr>
<tr>
<td></td>
<td>Missing: 3,607 people as November 24, 2011</td>
</tr>
</tbody>
</table>
1-2) Damage situation of Casting factories and resuming operation (Except die casting)

(1) Damage occurred in 49 factories at northeast and Kanto area.

<table>
<thead>
<tr>
<th>Area</th>
<th>The total number of factories (a)</th>
<th>The number of investigation factories</th>
<th>The number of damaged factories (b)</th>
<th>b/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>36</td>
<td>36</td>
<td>28</td>
<td>77.8%</td>
</tr>
<tr>
<td>Kanto</td>
<td>275</td>
<td>83</td>
<td>21</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

Although part of the building was damaged, the main equipment didn’t have the serious damage. There is no damage caused by the tsunami. Many foundry factories are located in the inland. No human damage occurred in the factories.

(2) Resumed operation

After 2 weeks, most of the foundry factories resumed operations, and after 1 month, they returned to normal operation.
1-3) Nuclear power plants in Japan

There are 54 nuclear reactors in Japan. Only 2 reactors are operating now.
1-4) Problems after Great East Japan Earthquake

After the earthquake, foundry industry is facing with the following two big problems.

(1) Energy problem caused by Fukushima nuclear accident
   (Item2)

(2) Strong yen
   (Item3)
2. Energy cost increase

(1) In this May, the Fukushima nuclear accident led to suspend all the Japanese reactors, and in this July a few reactors operated again. Now, only 2 reactors are operating.

(2) Japanese nuclear power accounts for about 1/4 of the power generation, but it stopped. After that, the alternate thermal-power-generation caused electricity price to rise.

2-1) Surcharge increased by 0.2～1.2yen/kWh
2-2) Tokyo Electric Power Co. raised electricity price by 15% from this April.
2-1) Electricity constitution of Japan

- Continuing electricity shortage

> If the nuclear power plant doesn’t operate, we should increase thermal-power-generation that uses oil. → Rise of electricity cost
2-2) Influence of power outage in Tokyo Electric Power Co’s areas

(a) There are 10 Electric companies in Japan, and electricity is delivered into divided 10 areas.

(b) The nuclear power accident occurred in Tokyo Electric Power Co’s areas. (Including Tokyo)

(c) After the great earthquake, the electricity shortage happened, and the planned power outage was conducted.

(d) As a result, some industries shut down the operation. Foundry factories are operating with great inefficient.
2-3) Nuclear power reactors re-operation

(a) Nuclear power generation accounts for 29% of all electricity generated in Japan. All nuclear power reactors stopped in May.

(b) Therefore 15% of power shortage occurred in Osaka area of Kansai Electric Power Co., this year’s summer.

(c) In this area, the two nuclear power reactors have started operating again in July.

(d) Public opinion divided into two; (1) All the Japanese unclear power plants should be shutdown. (2) They should be re-operation.
2-4) Renewable energy feed-in tariffs

(a) In August 2011, Japanese government enacted a law electric power providers must purchase renewable energy.

(b) This purpose is to increase this renewable power generation by purchasing it with high price.

(c) The consumers should absorb the cost for the purchase. Foundry companies also have to share the lost.

(d) Power-mass-consumption companies could receive a benefit of reducing charge.
2-5) Purchase price

(a) Current electricity prices (yen/kW)
   home electricity            20.54
   industrial electricity      13.77

(b) Purchase price for the renewable power electricity (yen/kW)
   (1)solar power generation    42
   (2)wind generation           23.1
   (3)geothermal generation     27.3
   (4)biomass generation        13.65~40.95

*The providing period is for 20 years.
2-6) Charge reduction measure

Condition (1): Its electrical usage (“consumption rate”) is 8 times (in detail 5.6 times) than the average of manufacturing industry.

Condition (2): Its annual electrical usage is more than 1,000,000kWh. (1 million kWh)

*If some companies meet the above 2 conditions, they are allowed to reduce charge by 80%. (Pay only 20% charge)
2-7) Prediction of reduction measure for foundry companies

(1) Annual electrical usage:
Approximately 40% of foundry companies uses more than 1 million kWh and can receive a benefit from the measure.

(2) Electric power consumption rate:
Only 15 to 20% of foundry companies meet the consumption rate (more than 8 times) and can receive the benefit from the measure.
2-8) International comparison of industrial electricity prices of developed countries (US dollar conversion)

The electric power charge for the casting increases continuously.
3. Strong yen

With the yen’s strong surge, car makers, industrial machinery makers and electronic makers, are accelerating the oversea transfer, and are reducing the domestic market.
3-1) Influence of the strong yen

(a) Many industries lost their international competitiveness. Especially, home electronics makers and information appliance makers receive a big influence.

(b) Many assembly industries transferred the factory overseas. Also, for parts manufactures, constructing the factory abroad was only way to survive.

(c) Hand molding foundry factories remained in Japan, but users strengthened oversea supply, so orders are decreasing.
3-2) Change in user’s market

Overseas deployment of users which use casting material

The sudden rise of the exchange rate of yen and the dollar has accelerated the overseas deployment of the enterprise.
The production of no-ferrous casting exceeded 45% in 2010.
3-4) World casting production in 2010

Reference: Modern Casting

(1) Asia is the foundry factory for the world. (63% of the world casting production)
(2) There are 950 companies in Japan, 250 companies in Germany, but the total production volume is the same. Japanese company’s productivity is 1/3, compared to Germany.
4. 2011’s trend of Japanese casting industry

(a) Main factors of the Japanese economy
  - Decrease in population
  - Overseas transfer of production bases
  - Electric power crisis

(b) Current state of casting industry
  - Too much small casting factories
  - By the reduction of cars weight, casting products decreased.
4-1) Transition of Japanese Population

Old age society with a falling birthrate

[Diagram showing population trends over years, with labels indicating million people, working age population to one senior citizen, estimated figures, and population of senior citizen.]
4-2) Present State of Japanese Casting Industry in 2011

Transition of Casting productions

Production = 4.36Mt (2011)
(over a year ago +0.7%↑)

Iron casting production for the car comes to 50% or less in 2010.
→Demand of thin wall thickness and weight reduction.
There is a demand of material change.

Production of each sector

Automobiles 48%
Industrial machines 37%
Public Sector 9%
Others 6%

Predict 4.50Mt
About 50% is a small foundry. Their employee’s number is 20 or less. Therefore, the casting productivity is low.
4-4) Production by company size (2008)

The number of iron based casting companies: 974

- Production: 5.72 million tons

The number of small casting companies which have less than 50 employees is 78%.

4-5) Changes in the amount of non iron casting production

- Amount of production, 100 billion yen

**Copper alloy**

**Light alloy**

**Die-casting**

**Die-casting aluminum**
4-6) Change in customer’s request into Iron Casting

<Problems of the passenger cars>
- Strengthening of exhaust emissions regulations.
- Improvement of fuel efficiency of passenger car.

<Countermeasure situation>
- Thin wall thickness and light weight casting
- Change of the using material

Fig. Transition of materials used for automobiles
5. New efforts of Japan Foundry Society

1) Deliberate planning of personal education

   > Education training course for freshmen
   > Casting college

2) Creation of the attractive working environment

   ➢ Adoption of green sand
     with a little dust generation.

     → Artificial Sand
5-1) Deliberate planning of personal education

— Casting College —

a) The casting college began to promote the executive candidate of the casting company in fiscal year 2007.

b) There are 4 courses in the casting college; the cast iron, cast steel, the copper base alloy, and the aluminum casting.

c) It needs 100 hours for the lecture and the practice of the casting during the fiscal year.

d) Japan Foundry Society and Japan Foundry Engineering Society are managing the casting college together.

e) 385 people graduated from the casting college for five years from fiscal year 2007 to fiscal year 2011.

f) The graduates in the casting college has received the high appraisal from the member’s companies.
5-2) Creation of the attractive working environment

Expansion of “Artificial Sand” application —

The artificial sand has a true spherical shape. It has a small coefficient of thermal expansion. The operating life of sand is long.

a) Good points of an artificial sand

(1) Quality improvement and reduction in cost

(2) Environmental improvement and decrease of environmental cost.

> The working environment is improved.
  • Silica content in dust is lowered.
  • The amount of dust is decreased.

> The industrial waste is decreased.
5-3) Comparison between alumina artificial sand and silica sand

<table>
<thead>
<tr>
<th></th>
<th>Al₂O₃</th>
<th>SiO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>alumina artificial sand</td>
<td>73.32%</td>
<td>17.20%</td>
</tr>
<tr>
<td>silica sand (iide)</td>
<td>4.84%</td>
<td>91.26%</td>
</tr>
</tbody>
</table>

Environmental change at shake-out room (content rate)

<table>
<thead>
<tr>
<th></th>
<th>Before introduction</th>
<th>After introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free silicate acid</td>
<td>9.7%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

By using the artificial sand (containing lower SiO₂), free silicate acid decreased greatly, and the environment of shake-out was improved.
5-4) Changes of the dust after introducing artificial sand

(a) Before Introduction

(b) After Introduction

SEM and Si mapping of the dust
5-5) Japanese standards for environment management

• Management standard 3: Must improve the environment (National improvement order for bad environment.)
• Management standard 2: Should improve the environment
• Management standard 1: No environmental problem
5-6) Environmental improvement by introducing artificial sand
Dust collecting equipments are same

<table>
<thead>
<tr>
<th></th>
<th>Before introduction</th>
<th>After introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>March 2008</td>
<td>August 2008</td>
</tr>
<tr>
<td>Shake-out place</td>
<td>management 3</td>
<td>management 2</td>
</tr>
<tr>
<td>Molding place A</td>
<td>management 2</td>
<td>management 1</td>
</tr>
<tr>
<td>Molding place B</td>
<td>management 2</td>
<td>management 1</td>
</tr>
<tr>
<td>Shot place</td>
<td>management 3</td>
<td>management 1</td>
</tr>
</tbody>
</table>
Thank you for your kind attention.

ARIGATO!

Hiroyoshi Kimura

JFS, Inc.
# Appendix: Production Data

## 1. Changes in the amount of iron casting production

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>7.72</td>
<td>6.65</td>
<td>6.19</td>
<td>6.34</td>
<td>5.61</td>
<td>5.50</td>
<td>5.06</td>
<td>4.91</td>
<td>5.24</td>
</tr>
<tr>
<td>Weight</td>
<td>5.44</td>
<td>5.62</td>
<td>5.81</td>
<td>5.86</td>
<td>5.71</td>
<td>3.54</td>
<td>4.20</td>
<td>4.36</td>
<td>4.50</td>
</tr>
</tbody>
</table>

## 2. Changes in the amount of non iron casting production

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper/copper alloy castings</th>
<th>Aluminum alloy castings</th>
<th>Die castings</th>
<th>Aluminum alloy die castings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (t)</td>
<td>million yen</td>
<td>Weight (t)</td>
<td>million yen</td>
<td>Weight (t)</td>
</tr>
<tr>
<td>1990</td>
<td>110,574</td>
<td>111,733</td>
<td>395,403</td>
<td>310,825</td>
</tr>
<tr>
<td>1995</td>
<td>109,263</td>
<td>97,568</td>
<td>396,635</td>
<td>299,067</td>
</tr>
<tr>
<td>2000</td>
<td>87,093</td>
<td>70,078</td>
<td>412,824</td>
<td>287,794</td>
</tr>
<tr>
<td>2003</td>
<td>100,623</td>
<td>74,531</td>
<td>393,118</td>
<td>255,680</td>
</tr>
<tr>
<td>2004</td>
<td>105,500</td>
<td>83,349</td>
<td>397,931</td>
<td>260,137</td>
</tr>
<tr>
<td>2005</td>
<td>97,794</td>
<td>82,269</td>
<td>412,483</td>
<td>279,079</td>
</tr>
<tr>
<td>2006</td>
<td>105,864</td>
<td>114,738</td>
<td>435,420</td>
<td>307,155</td>
</tr>
<tr>
<td>2007</td>
<td>106,932</td>
<td>132,464</td>
<td>431,982</td>
<td>320,302</td>
</tr>
<tr>
<td>2008</td>
<td>98,782</td>
<td>129,101</td>
<td>414,004</td>
<td>308,507</td>
</tr>
<tr>
<td>2009</td>
<td>75,284</td>
<td>83,906</td>
<td>291,923</td>
<td>207,365</td>
</tr>
<tr>
<td>2010</td>
<td>79,293</td>
<td>95,758</td>
<td>386,812</td>
<td>263,108</td>
</tr>
<tr>
<td>2011</td>
<td>83,140</td>
<td>107,876</td>
<td>375,242</td>
<td>251,708</td>
</tr>
</tbody>
</table>