Entire Foundry Production "Management" to achieve "Quality Castings"

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Foundries constantly have been improving to achieve "high quality", "high productivity", "saving energy", "near net shape casting", and "manpower saving". However, there has been little unitary data management system for entire foundry production. The authors have developed the entire foundry production "management" system to support the total operation.

The developed management system enables to grasp casting conditions by monitoring production data. For this system, various measuring devices are equipped in each process, and the production data is digitized, monitored and stored as integrated database. Then, the database is utilized unitary. In order to realize "quality castings", it is very important to grasp and feedback the operation condition data such as pouring, molding and green sand properties.

Moreover, this system is also able to cover many other purposes; for example to save consumption of electric power, water, and compressed air. The digitization of the energy consumption contributes to reduce total energy consumption. In addition, it also enables immediate response towards abnormal energy consumption.

The developed foundry production management system enable to build strong management foundation and produce high quality castings.

Keywords: production management, digitization, quality casting, high productivity, saving energy and manpower

1. Introduction

In recent years, foundry companies have required the advanced production management system with the decline in the labor force population and the aging of skilled engineer.

This presentation explains a developmed production management system to contribute the future foundry management.

2. The Contents of development

This development consists of two fields.

- 1) Management Support Software
- Production Management System
- -Traceability Device / Monitoring System
- 2) Utility Total Monitor
- Electricity, water, compressed air

"Management Support Software" monitors information gotten individually such as cooling condition, molding line and sand properties and utilizes them as a database of production trace data in addition to the operation rate or production order.

"Utility Total Monitor" is the system to manage energy such as electric, water and compressed air. It contributes to reduce the total energy with digitizing the consumption at the points to be measured. Moreover, this system monitors the abnormality such as sand properties causing the casting defect. From the above, it realizes the preventive maintenance towards the abnormal energy consumption or the casting defect.

3. Utilization in foundry

3.1 Quality of casting

The efficient production of quality casting is one of the most important task for the foundry.

Production Management System, one of management support software, is able to support making high quality casting. Using Production Management System, various information of each mold is monitored and digitized such as pouring, cooling, molding condition, sand properties and so on.

An example is shown in Fig. 1.

Production data 2015/09/02 = Shift = 3 Molding start time : 071451 Pattern No:0101 Molding start time : 10412.0 Pattern No:01073										
Produc informati	t N ion c	/lold lata	Molding data	Sand Parting po	_{wder} Po	Pouring		en metal portation	Cooling	
Group :	Group 1 O Group 2 O Group 3									
Molding time	Pattern No	Casting result	Position of setting Cope flask board	Cope flask's Mold thickness	Cope flasi compressit	Pos k's s billity Dra t	aition of etting og flask board	Drag flask's Mold thickness	Drag flask's compressibility	
2015/09/02 7:14:51	101	Defect molding	273.5	206.1	24.6	2	70.3 208.7		22.7	
2015/09/02 7:15:21	101	Pouring	257.9	197.4	23.4	2	251.5	193.8	22.9	

Fig. 1 Production Management System

It is integrated and utilized unitary as a database. The monitored data is used in various applications, for example, linking with data to eliminate casting defect. In addition, this system alerts the inspection department to the casting defect produced by the abnormal property sand, etc.

As mentioned above, this system provides the production system with fewer casting defects.

3.2 High productivity

The productivity is also important factor for foundry as much as the quality.

Production Management System also contributes to improve the productivity.

Figure 2 shows molding machine operation rate.

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Production Management	Operation rate	
Sand processing Molding line Production instruction Actual production	Shift 1 Operation rate[%] 65.3 Operation time 00:03:03 Start time 2015-06-22 08:01:30 cycle[sec] 20.0 Stop time 08:14:06	Present process
Daily report Actual pouring Grinding Actual projecting	Present Abnormality	Present Stop

<u>Quality</u> <u>Management</u>	Production rate									
Actual test Daily report Molding history Product Information Casting data Slipnage of mold	Production program				Actual molding Molding prescribed 1491 Number of 973 number molding Number of 762 Number of 0 pouring 762 Number of 0					
Pouring history	Order of production	Pattern No	Product number	Prescribed number	The start time of molding	Pattern No	Product number	Number of molding	Number of molding defects	Number of pouring
Pouring transportation Pouring	Present mold	43		119	15:55:27	43		69	0	31
Dividing	Next mold	168		135	14:50:37	183		90	0	86
Cooling	The time after next mold	165		112	14:35:29	46		40	0	40
Post processing MTB Sprinkling	One after another next time mold	148		107	13:46:19	57		128	0	128
Sand processing	5	59		168	13:11:24	73		97	0	97
MIA BMic+MIE	Actual product									

Fig. 2 Molding machine operation rate

Operator can grasp the current production condition with checking molding machine operation rate.

In addition, "Remote Monitor" is utilized for the management of entire foundry production system.

An example is shown in Fig. 3.



Fig. 3 Remote Monitor

This figure shows the monitoring of vibration at shot blasting. When the value of vibration exceeds the certain value, this monitor system shows a warning.

Therefore, foundry can continue stable operation with Remote Monitor which continuously monitors the operation condition to react immediately for the abnormality.

3.3 Energy saving

In foundry, large quantity of energy has been consumed. Digitization of energy consumption contributes to save total energy consumption.

Figure 4. shows digitized electric power consumption in foundry.



Fig. 4 Electric power consumption

In addition, it also enables immediate response towards abnormal energy consumption.

4. Conclusion

The developed foundry total management system is first step for "Industry 4.0". The developed system would contribute to reduce a casting defect dramatically and produce high quality castings with low energy.