O-49

Future Foundry Sand

Zhu Jianxun
Shengquan Group
Diaozhen Industrial Development Zone, Zhangqiu, Jinan, PRC

Sand has been widely used in big quantity not only for sand-mould casting, but also in lost foam , full mold, V-process, low pressure and metal mold gravity castings. Except the big consumption amount, it has significant influence on casting quality, working environment, environmental protection and production cost.

Deep analysis, trials and discussion on a variety of foundry sands, including quartz, chromites, zircon, olivine, bauxite, artificial ceramic sand have been done in this paper. The tendency of foundry sand has also been revealed: high quality and precision, functionalization, wide spread application of non-quartz and artificial spherical sand, finer granularity and non coating sand, new reclamation technology and 100% and non-hazardous recycling of used sand, 100% separation and reclamation technology of special sand, globalization of the foundry sand resource, variation of test methods and the new "3D" sand application.

Key Words: *Foundry sand, eight trends*

1. Introduction

The annual requirement of new sand will be 42 million tons, which also means 42 million tons of waste sand is disposed every year[1,2], which brings serious damage to the resource and environment.

Foundry sand possesses important influence on casting quality (e.g. dimension precision, surface finish) and some casting defects (metal penetration, burrs, shrinkage cavity). 50% of the casting defects are related to the sand [3, 4].

2. Future foundry sand will be high quality and more fine sand.

Future high quality sand will be higher SiO2 content, more rounded grain shape, lower clay content and the amount of fines and narrower AFS range. There will be new silica sand surface treatment technology. Development and application of finer and denser silica sand without coating and application of low expansion calcine.

Higher requirement and narrower control on sand specifications, which means sand strength should be improved by at least 20%, sand quality influence on casting rejection rate and quality problems should be reduced by at least 30%, and sand reclamation rate will be increased by at least 5%.

3. Artificial ceramic sand will be the next major casting sand in future.

Manufacture of artificial spherical sand.

Basically spherical artificial sand is resourced from rich Al-Si-based ore, and made by four processes.

They are mechanical granulation and sintering, spray granulation and sintering, fused spray granulation and Plasma arc granulation.

Advantages of artificial spherical sand.

Chemical composition is stable and adjustable, high refractoriness and wide applicability. Low thermal expansion coefficient. High bulk density and good thermal conductivity. High hardness, round grain shape and good heat resistance. Round shape and good surface finish. Improved sand reclamation rate. Improved casting yield and casting quality. Lower production cost.

Future development of artificial spherical ceramic sand.

It will gradually replace the silica sand and other sands. Its consumption may be even more than the amount of quartz sand in future. Artificial spherical ceramic sand will develop non-silicon system (such as MgO-SiO2), pure silica system, and pure Al2O3 system containing Fe3O4 system, lower Al2O3 system so as to meet different needs and reduce manufacturing costs. Spherical ceramic sand for inorganic binder system will also be developed.

4. The functionalization of foundry sand .

High permeability to solve porosity defects. Low-expansion sand brings higher casting dimensional accuracy, and solves problems of broken cores and burr defect. Insulation sand improves production yield. High-strength sand. High refractoriness, high fineness and high bulk density foundry sand which does not need coating.

5. "100%" Reclamation and Re-utilization of Foundry Sand.

This concept is consisted of three ideas. First, "100%" refers to rate of 99% or higher than 99.5%. Second, treatment will be pollution-free. The prevail thermal reclaiming method has disadvantage of low burning temperature (<700℃). Organic binder on the used sand is not able to be fully decomposed by combustion. Harmful gas such as dioxin may be released to the environment. Remained solid dust like fine powder and sand from mechanical or wet reclamation method contains organic and inorganic binding agent. Pollution-free treatment is brought to light to solve these problems. The third idea is re-utilization of used sand as resource. After pollution-free treatment, unrenewable used sand and solid powder will be reutilized as resource.

New wet reclaiming method for green sand. New hot reclamation method. New Mechanical Reclamation. New inorganic binder reclamation technology.

New development of special sand separation and recycle technology。

Gravity separation and reclaiming technology. Grain size screening separation and reclaiming technology.

6. New development of 3D casting sand.

The silica sand which is finer (AFS＞100), rounder (Circularity＞0.9),and with higher stacking density (wider grain size distribution) will be developed.Modification to 3D foundry sand surface, which helps improve sand wettability and adhesion , increase the strength of 3D cores.

7. New test method of the foundry sand.

Application of new test method for foundry sand particle shape. Rapid test on the foundry sand particle distribution. Test on the flow ability and bulk density. Test of high temperature performance.

8. Internationalization of foundry sand market.

In future, with development of casting technology and casting quality, also the development of high-quality foundry sand, and significantly increased sand reclamation rate (> 95% ---> 97%), foundry plants will use better quality sand, which will then reduce cost and bring the environmental benefits, the foundry sand will cross-border and sell to the international market, and promote the development of the global foundry industry.

References

[1]Foundry Sand Reclamation—Theory and Industrial Practice, R.Dańko~1 J.Dańko~2 M.Holtz

[2]Analysis of casting defects and identification of remedial measures - A diagnostic study, D.N.Shivappa~1,Rohit~2 and Abhijit Bhattacharya~3

[3]A.Z.Zook,"Low-Emission Core Binders Core Sand Dilution".71th World Foundry Congress(2014).

[4]A.J.Oman."Next Generation Thermal Distortion Tester".71th World Foundry Congress(2014)