The Application of CCITEK® Inorganic Technology for Foundry Sand

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Abstract: The CCITEK® Inorganic coated wet sand is a casting (core) sand product based on the CCITEK® inorganic binder technology. The core temperature is low, and it belongs to the warm core box coated sand using inorganic materials in the current casting industry.

In this paper, through the introduction of the technical principle and the application of the technology and the sand process and the application effect of sand mixing, core making and casting, the author shows that this new inorganic coated wet sand technology has the environmental protection characteristics of dust-free, smokeless and tasteless in the whole life cycle.

The application of this technology has no pollution to the environment, zero harm, can reduce the input of foundry equipment, reduce energy consumption, solve the defects of orifice, shrinkage and expansion of casting, improve the yield of casting, and improve the production efficiency.

Keywords: inorganic binder; sand; waste sand regeneration; environmental protection; foundry

1 Introduction

CCITEK® inorganic coated wet sand technology is independently developed by Chongqing Changjiang River Moulding Materials (Group) Co., Ltd（hereafter simply called: CCRMM, with more than 10 related patents, with full intellectual property rights.

Changjiang Materials has raised funds, established internal projects, planning and research, and has been put into practical application since 2012, and completed the new product appraisal and acceptance of Chongqing Municipal Government Economic and Information Technology Commission in the same year.

After more than ten years of development and application optimization, it has formed a mature and reliable original technology system, which is a new green sand technology with unique technical characteristics. It has a broad application prospect.

2 Experimental procedure

The basic technical characteristics of CCITEK® are based on the research of existing inorganic cementitious materials, using other non-homologous inorganic gel materials to modify them, and a new silicate inorganic gel technology route that breaks away from traditional water glass technology has been determined. And this unique composite modification technology is extended to the phosphate inorganic cementing system, achieving a new technological innovation of water-based inorganic binder technology with two major categories of silicate and phosphate inorganic cementing structures.

The binder: component one, liquid, its composition content is shown in Table 1. The binder: component two, powder, it's element content are shown in Table 2.

Table 1. The composition content of component one

Composition	Silicate	Chemical doping components	Modified & additives, water	PH	Viscosity（s, 25℃, 4# flow cup）
Content	24%-27%	6%-17%	59%-67%	13-14	12-17

Table 2. The element content of component two

Element	SiO_2 %	Al_2O_3 %	Others %	Water content %	LOI %	Loose accumulation density g/cm^3	Degree of dispersion
Content	70-80	≥12	2-3	≦1	≦6	0.4-0.6	≥5%

CCITEK® inorganic wet coated sand technology is a new sand casting technology developed based on inorganic cementing technology and five key technologies. The essence of the inorganic cementing technology is the modification of composite material technology, five key technologies include the key technology of preparation and evaluation, inorganic wet sand preparation and evaluation, core (type) pouring and evaluation of key technology, inorganic waste sand regeneration and evaluation of key technology, etc.

Recommended dosage of binder: component one, liquid 1.8-3.0% (sand amount basis); component two, powder 40% (component one, liquid amount basis).

Refractory aggregate： Baking silica sand, Dry silica sand, Recycled sand, etc.

The main technical performance of CCITEK® inorganic wet coated sand are shown in Fig.1,2.3,4,5 and 6.

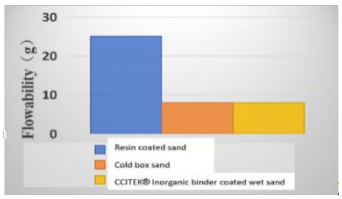

Fig.1 Comparison of fluidity of several kinds of coated wet sands

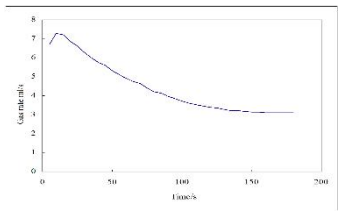

Fig.2 Gas evolution of inorganic wet coated sand

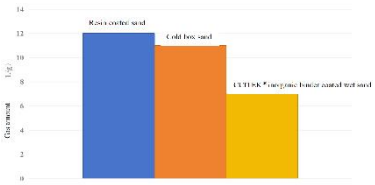

Fig.3 Comparison of the maximum gas output of several molding materials

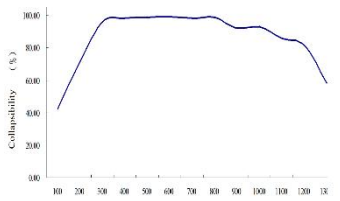

Fig.4 Collapsibility of CCITEK® inorganic wet coated sand at different temperatures

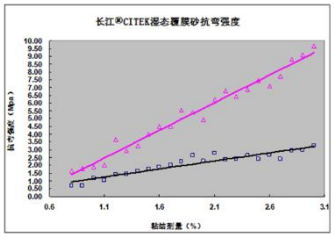

Fig.5 The relationship between bonding dose and strength

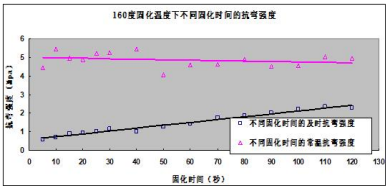

Fig.6 The relationship between curing time and strength

Core curing behavior mainly in the hot sand caused more system of chemical polymerization between inorganic materials, makes the interface of inorganic cement gradually adhesive curing, the formation of inorganic film high shear strength between sand consolidation into sand (core), at the same time in the process of sand curing only inorganic gel solvent phase-water in the form of water vapor, the whole core link only water vapor. The curing process is shown in Fig.7.

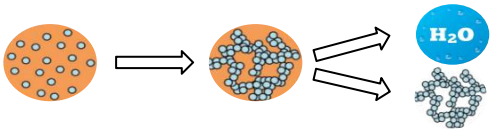

Fig.7 Schematic diagram of curing

The curing of inorganic binder belongs to the chemical curing mechanism triggered in a hot environment, which is different from the sand mixing method and curing conditions of other traditional molding sands. Therefore, the preparation technology of wet sand is completely different from the traditional preparation technology of other molding sands, which is reflected in the following aspects, as shown in Table 3.

3 Result and discussion

CCITEK® coated wet sand, which based on CCITEK ® inorganic binder technology, is a casting material (core) sand product The core making temperature is low (150℃~200℃). The core making and casting are smokeless, tasteless and non-toxic, which is an environmentally friendly product. It is especially suitable for the use of core aluminum casting of non-ferrous metal casting, to solve the pores, shrinkage, veins, holes, expansion defects, improve the strength of casting parts, solve the collapse of sand core, and improve the casting yield, improve production capacity, reduce the comprehensive cost, but also suitable for some simply shell for iron casting core making.CCITEK ® inorganic

binder is founded on Five key technology systems, that is , key technologies for the preparation and application evaluation of binder, key technology for wet sand preparation, sand (shell) core engineering and equipment key technology, key technology of casting application and management, inorganic waste sand regeneration process and equipment key technology. In Fig.8 and Fig.9 inorganic waste sand regeneration process and equipment are shown.

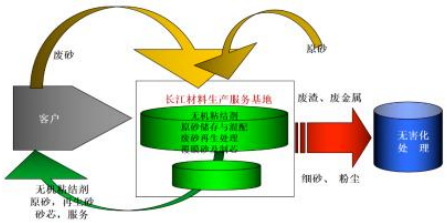

Fig.8 Inorganic waste sand regeneration process

Fig.9 CCRMM's CZS Re generation Equipment

4 Conclusion

CCITEK ® wet-coated sand is a casting (core) sand product based on 长江 ® CCITEK ® inorganic binder technology. It has a low core-making temperature and is currently the warm core box coated sand using inorganic materials in the foundry industry.

This technology product has the characteristics of being smokeless and odorless during core making and casting, does not pollute the environment, has zero harm, can reduce foundry investment, reduce energy consumption, and improve production efficiency; Solved the defects of casting porosity, shrinkage, and expansion, and improved the casting yield.

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Table 3 Comparison of inorganic coated wet sand with cold box resin sand and self-hardening sand

	Inorganic coated wet sand	Cold box resin sand	Self-hardening sand
Binder	Water-based low viscosity liquid	Two-component liquid	Viscous liquid
Curing agent	Ultrafine powder	Triethylamine	Liquid
Curing method	Hot (blowing hot air) curing	Blowing triethylamine gas	Room temperature self-curing