

Green Foundry Technical Comprehensive Solution —The Cross-Border Applications of New Materials and Process

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Abstract: “Green Foundry” as a new name which is an environment- friendly Foundry Technical Comprehensive Solution with the meaning of lower emissions, higher casting yield and the best cost-effective molding process with service package. The systematic balance of foundry sand system in foundry is the key point of the “Green Foundry” which covers two issues of new silicon-based materials with the corresponding molding process in a broad sense. From the systematic molding sand recycling equipment to the application with this new silicon-based material additives in the molding process corresponding to the molding sand system in foundry, this paper paid more attention on the technical node of reclamation and sustainability optimization of molding sand system. New materials emphasis this new additives with micron-sized fused quartz powder can improving the application performance of reclaimed sand. Another, New molding process with equipment, this paper expounds the process node of sand recycling equipment combined with new additives in order to achieve the best process balance and cost-effective in foundry. This article is more objective to clarify the foundry industry in the shape of raw/auxiliary materials, sand treatment equipment and process control is an inseparable whole. It need to be recognized in a specific process environment with cross-border ideas to discover the technical commonalities in different industries.

Keywords: Green Foundry; molding sand; silicon-based material; sand mold additives; foundry sand system; micron-sized fused quartz powder; environment- friendly

1 Introduction

The molding process in the foundry industry is developing around the sand system, and the sand molding process is composed of three main molding materials: foundry sand, binder and coating. Sand treatment equipment in the traditional sense is composed of sand recycling equipment and related auxiliary machinery to form a complete set of systems. Therefore, materials and equipment are the two key elements of the sand molding process. In recent years, green foundry mainly lies in the effective utilization of the integration of molding materials and sand treatment equipment to achieve the cost-effective comprehensive indicator. With the promotion of environmental awareness of foundries all around the world, the solution of lower VOC

emission and molding cost is the double factor of foundries. Based on the balance of economy and technology while facing a variety of molding process on the dimensions of materials and equipment, the introduction of cross-industry common cognition for foundry enterprises to achieve a better sand system solution for the case and relevant data analysis in order to promote the productivity of foundry industry and reducing costs and increasing efficiency. The foundry used sand recycling equipment is discussed in cross-industry cases related to thermal and wet method combined with Industrial water treatment sewage treatment and thermal cycling. The new silicon-based additives get relevant inspiration from EMC packaging industry and applied in the foundry industry.

2 Experimental procedure

Taking inorganic sodium silicate molding process as an example, wet reclamation is the most suitable method so far, and the practice has proven that the reclaimed sand can meet the needs of the whole sand molding process. The sodium silicate used sand samples that has mixed with 5000 mesh (the average particle size is $2.5 \mu\text{m}$) fused silica powder as a test object. The optimal reclaimed result was achieved under the conditions of distilled water with the corresponding temperature, soaking and scrubbing retention time. Hot water in the whole testing process can accelerate the dissolution of silicate binders to effectively reduce the residual Na_2O index of the reclaimed sand. After the test, the recycled water is simulated by the condenser for MVR water treatment in the sewage treatment industry and the index of recycled water reaches the effluent standard. The heat source required for water heating in wet reclamation and MVR sewage treatment comes from the reuse of waste heat in thermal reclamation system. The heat source of the wet reclamation process in the thermal and wet process linkage line comes from the waste heat of the hot calcinator and water cooling system dedicated for the used sand reclamation of the organic binder sand molding process. The heat source of the wet reclamation simulation testing came from the constant temperature electric heating under the same testing conditions with the process of soaking in hot water at 60°C for 5 minutes and scrubbing at different mortar concentrations for 5 minutes.

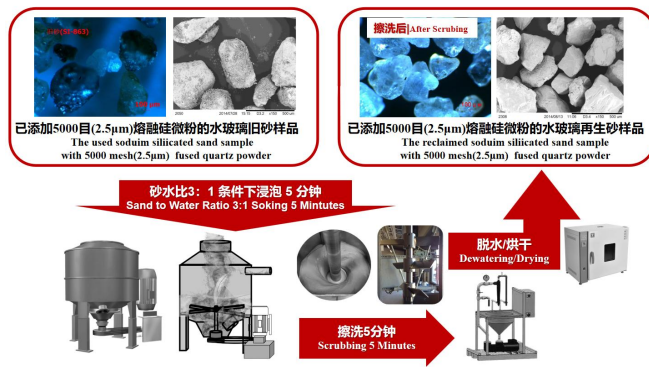


Figure 1 Full Test Process Analysis

3 Result and discussion

The corresponding inorganic sodium silicate used sand reclamation testing process simulated the advanced sewage treatment technology. After the sewage in this new process is treated by server main processes such as precipitation, flocculation and neutralization, the chroma of clean water chroma less than 60, then through the MVR technology to obtain pure circulating water in order to achieve near-zero emission of sewage and Solid.

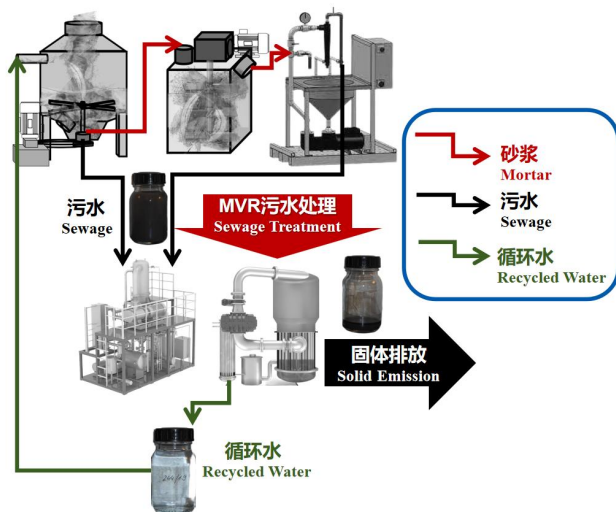


Figure 2 Full Sewage Treatment Process Analysis

Based on the basic strength analysis of four sand samples concluded that the reclaimed sand with new additives of fused silica powder has the best performance under the same testing conditions. It means that fused silica powder can form a dense ceramic sintered layer covered the silica sand grain when meet temperature above 1200℃ in order to improve the molding sand strength.And it can make a

perfect bridge between binder and sand particle.The follow Table 1 and Figure 1 shows basic performance of these four initial strength , 24h strength and retained strength. So as a new cross-border silicon-based materials can be applied in our foundry industry. It will have a good potential value.

Table 1. Basic Performance Parameters of Sand Sample

| Sand Sample | Initial Strength /MPa | 24h Strength /MPa | Retained Strength /MPa |
|----------------------------|-----------------------|-------------------|------------------------|
| New Sand | 0.461 | 1.892 | 1.822 |
| Used Sand | 0.045 | 0.339 | 1.576 |
| Reclaimed Sand | 0.618 | 1.529 | 1.573 |
| Reclaimed Sand (Additives) | 0.652 | 2.601 | 1.936 |

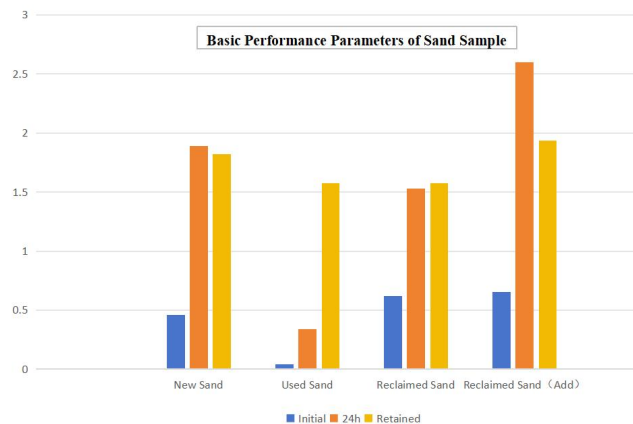


Figure 1 Effects of Reclaimed Sand with New Additives

4 Conclusion

Foundry Sand Treatment System that combined with new process and materials need a cost-effective balance point and Standardized processing environment. Because flexible raw and auxiliary molding materials, we should find a green and universal sand molding solution face different foundries.

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