Product information

Special moulding materials

CERATEC
CERAPEARL
CERAPEARL 3D

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CERATEC special mold material

Due to the increasing complexity of component geometries, the ongoing development of materials with sophisticated casting properties, and customers' increasing quality requirements, classic mold materials used today (quartz, chromite sand, and zircon) are often pushed to the limits. This results in penetration or sintered cores and castings, poor surface quality, and a higher rejection rate.

The development of synthetic CERATEC as a special molding material for use in iron and steel casting has been proven to address these issues.

A mold material with almost perfectly spherical grains results in ideal flow behavior during core production. The mineralization of highly thermally stressed core parts can be permanently avoided by using CERATEC molding material. The required surface quality is almost always achieved without additional grinding.

CERATEC mold material consists of sand grains that have an almost perfect spherical shape. Some of its key features such as high gas permeability, exceptional flow behavior, and substantially reduced binder requirement are attributed to this characteristic.

CERATEC can be used with all common binder systems and is compatible with both thermal and mechanical reclamation systems. Compared to the use of traditional raw materials for molds, binder usage can be reduced by up to 60%, depending on the binder system type.

Image 1: CERATEC 50

Material properties

With the reduced amount of gas resulting from binder burnout and the high gas permeability of CERATEC mold mixtures, casting defects such as gas bubbles or scabs can be avoided. As a result of its high thermal capacity, superior surfaces can be achieved with CERATEC. Even complex cores can achieve metal casting results comparable to ceramic castings.

The low average coefficient of expansion compared quartz sand is 7.2 · 10-6 K-1 in the range 20–600 °C, preventing the formation of veins and ensuring a significant reduction in cleaning costs.

The high Al_2O_3 content and high purity leads to excellent mechanical and thermal stability. This prevents the formation of mineralization and metal-mold reactions, as shown in Images 2 and 3.

CERATEC's tremendous cost savings arise from its low level of disintegration and good casting surfaces in the fettling shop.

Due to the increasing complexity of geometries with modern cast components, foundries are often forced to exhaust the properties of conventional mold materials. This often leads to an increased risk of rejects and the associated costs. Innovative mold materials such as CERATEC make it possible for the foundry to minimize this risk and to achieve premium-quality surfaces.

Image 2: Initial situation: conventional feeding technology without breaker core

Image 3: Riser knock-off area after optimization with CERATEC

Case Study – Housing

For the production of a 300-kg housing made of cast stainless steel, the cores that made up the control channels were made of chromite sand coated with magnesite. The component is subject to corrosion, so the surface quality must be excellent. The inner contours of the casting were completely mineralized. Removing the mineralization and subsequently grinding the surface to produce the required surface quality increased the cleaning time to 30 hours per casting.

Objective

The objective was to increase cost efficiency while maintaining or improving process reliability.

Task

The task was to produce a casting with no mineralization of the control channels and that would maintain the surface finish in the cast state.

Actions taken

Prevention of mineralization by using CERATEC molding material for the control channels. The surface finished was improved by using a particular variety of CERATEC with a finer grain together with a magnesite coating.

Image 4: Control channel with mineralization (chromite core)

Image 5: Control channel made of CERATEC

Application to CERATEC for the channel cores

Key data	CERATEC
Casting material	1.4517 GX2 CrNiMoCuN 25 6 3 3
Pouring weight	550 kg
Raw weight	300 kg
Pouring temperature	1.600 °C

Result

The additional finishing time of 30 hours per casting was eliminated. After casting, the control channels were completely free of mineralization. The required surface quality was achieved without having to grind the surface. The efficiency was significantly improved by increasing the process safety and eliminating additional finishing work.

Advantages

- low linear expansion coefficient
- vein-free castings
- high resistance to penetration
- suitable for high thermal loads
- all commercially available binders can be used
- binder savings of 35-60%
- good decomposition properties
- high surface quality (> 12.5 µm)
- lower density compared to chromite or zircon sand
- applicable for all types of castings
- free of chromium oxide
- disposable without restrictions

Technical overview

Physical and thermophysical key data

CERATEC	43	50	60	70	90
AFS grain fineness number	40–46	42–52	55–65	65–75	75–85
Median grain size (mm)	0.35–0.45	0.27–0.33	0.22–0.25	0.17–0.22	0.12–0.15
Density (g/cm³)	3,.4				
Bulk density (kg/dm³)	1.9–2.1				
Sintering point (VDG) (°C)	1,800				
Melting point (°C)	1,850				
Grain shape	round / 99%				
pH value	7				
Thermal conductivity (W/mK)	0,33–0,49				
Specific heat capacity kJ/(kg · K)	0.872				
Linear expansion coefficient ($a10^{-6} \cdot K^{-1}$)	20–300 °C 7.1		20–300 °C 7.3		20–800 °C 7.2

Chemical analysis

Special molding material CERAPEARL and CERAPEARL 3D

Due to the growing demand for special moulding materials, CERAPEARL and CERAPEARL 3D have been developed. The main focus with the development of of CERAPEARL was the application in 3D printing. Conventional mold and core production should still be be possible.

The moulding material, which have sand grains with an almost perfect spherical shape, sis characterized by optimum flow behavior during core production.

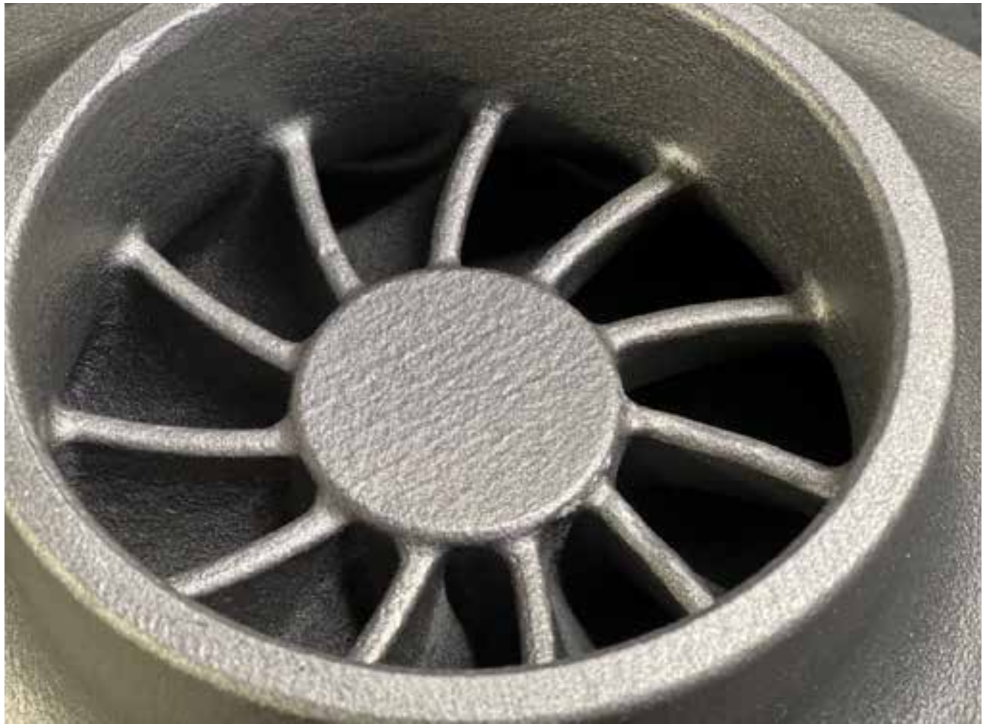
The CERAPEARL 3D is optimized for 3D printing due to its grain texture, and therefore, it can be processed with all common printer models.

By using the moulding material CERAPEARL / CERAPEARL 3D mineralization and veining in thermally highly stressed core areas can be specifically avoided. The required surface quality is almost always achieved without the need for grinding.

The CERAPEARL / CERAPEARL 3D moulding base consists of sand grains with an almost perfect spherical shape. This characteristic provides for high gas permeability and very good flow properties.

CERAPEARL / CERAPEARL 3D can be used with most any existing binder systems and production method, and it can be reclaimed both thermally and mechanically

Case study – impeller



In the manufacturing of impellers with complex blade geometries, the core is usually assembled from individual segments. This results in a considerable amount of core shop assembly work. In addition, burrs occur at the core joints, which have to be removed at great expense in the fettling shop. Backlash in the cores can lead to dimensional deviations, which can result in reworking or scrap.

Objective

The objective is to improve efficiency and quality.

Task

Production of an impeller that does not require cleaning in the media-carrying area.

Measures taken

Production of a monocore without core divisions using 3D printing from CERAPEARL 3D 65.

Result

By using a monocore made of CERAPEARL 3D 65, it was possible to produce an impeller which did not require cleaning in the media-carrying area. The plastering effort was limited to the gating and feeder surfaces as well as the dividing ridge. The plastering effort was reduced by 2 hours and the dimensional accuracy was improved.

Technical overview

Physical and thermophysical key data

CERAPEARL	43	50	3D 60	70	3D 105
AFS grain fineness number	40–46	47–53	61–69	66–74	100–105
Median grain size (mm)	0.35–0.45	0.27–0.33	0.18–0.22	0.17–0.22	0.11–0.14
Density (g/cm³)	**2.7–2.8**				
Bulk density (kg/dm³)	**1.55–1.65**				
Sintering point (VDG) (°C)	**1,750**				
Melting point (°C)	**1,800**				
Grain shape	**round / 99%**				
pH value	**7–8**				
Thermal conductivity (W/mK)	**0.22–0.46**				
Linear expansion coefficient ($a10^{-6} \cdot K^{-1}$)	**20–1200 °C 4–5–6.5**				

Chemical analysis

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