



CERATEC special molding sand



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 $7.2 \cdot 10^{-6} \text{ K}^{-1}$ 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 forma-

tion 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

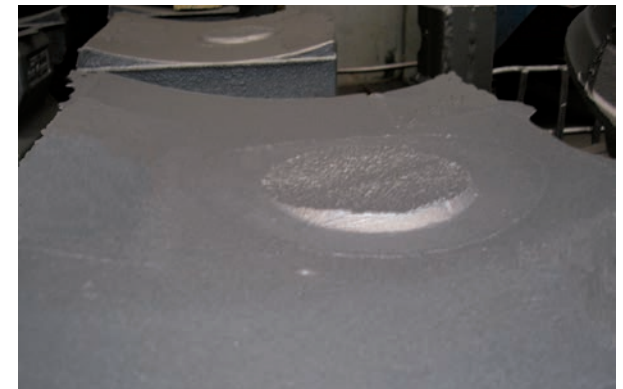


Image 3: Riser knock-off area after optimization with CERATEC

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

Application in 3-D printing

By combining our experience with CERATEC as a ceramic molding material and the various 3-D printing processes we were able to create an innovative printing medium.

The material is already being used today by several large 3-D printing companies, and the print heads and settings are adjustable to the material.

Please contact us if you have any questions.



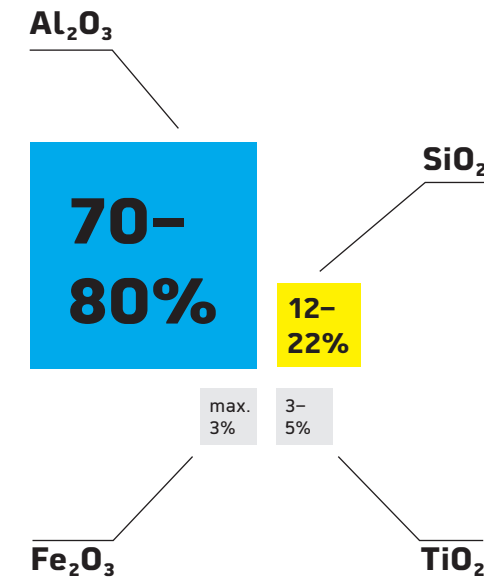
Image 6: 3-D-printed CERATEC core

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/cm ³)	3.4				
Bulk density (kg/dm ³)	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)	0.2				
Specific heat capacity kJ/(kg · K)	0.872				
Linear expansion coefficient (a10 ⁻⁶ · K ⁻¹)	20–300°C 7.1	20–600°C 7.3	20–800°C 7.2		

Chemical analysis



Highlights

-  Improved of surface quality
-  Alternative for zircon and chromite sands
-  Optimization of casting results due to high thermal load capacity with simultaneously lower linear thermal expansion
-  Reduction of binder consumption
-  Reduced risk of gas defects due to higher gas permeability



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