

MATERIAL SOLUTIONS FOR PERFORMANCE TOOLS

ADVANCED CERAMICS

ENGINEERING THE FUTURE WITH SUSTAINABLE SOLUTIONS.

INTRODUCTION AND APPLICATIONS

Performance Tools are structural ceramics where various shaping processes are used prior to machining and sintering. Our engineered raw materials and spray dried powders are used in:

- **industrial applications:** wire drawing rings, classifier wheels, textiles' thread guides, valves, pump piston sleeves but also ceramic rollers and a variety of other smaller and larger ceramic parts.
- automotive components such as seal rings or ferrules and
- medical applications in e.g. piezo-ceramic surgical devices, pump and valve components.

Thinking about the final parts properties such as strength, hardness, wear resistance, thermal shock as well as ceramic processes used or working for our customers to improve material characteristics, are part of our daily business.

SPECIFIC APPLICATION EXAMPLES

Industrial applications utilise a vast variety of ceramic materials. A precise material selection has to be made in order to achieve the technical and commercial requirements in relation to the specific purpose of the ceramic part.

Wire drawing rings can be made from our standard purity MgSZ (sinters to a yellow color), from high purity MgSZ (sinters to a white color) but also YSZ, ZTA or pure Al_2O_3 . The choice has to be made in function of performance, the customer's processing and size of the parts.

Wear resistance, fracture toughness, high thermal shock resistance and elevated operating temperatures under humid conditions favor use of MgSZ. A specific need for higher hardness, thermal expansion requirements may ask for different materials. Not only the starting material plays a role, Imerys offers different sizings and purities for all its products and offers for Zirconia a variety of stabilizing Mg and Y levels to support customers optimize processing and properties. Materials used in the production of **ceramic rollers** are chosen from white fused alumina, tabular alumina, calcined aluminas, fused mullite, zirconia, fused zirconia-alumina and plastic clays. A small portion of calcined alumina is also used in the composition.

The reaction between the clay and the alumina leads to the formation of mullite which is good for thermal shock resistance. Thermal shock can be further improved by addition of Zirconia (different sources are possible). It is also said that the zirconia in the end improves the Young modulus (modulus of elasticity). The service temperature of the rollers is about 1300C with thermal cycling.

Zirconia may also be used in a more pure form as Yttria stabilized zirconia YSZ as a thermal barrier coating and providing a chemicals resistant coating on metal rollers that are used for pulling-straightening in e.g. roller mills in the metal industry. Imerys provides 8wt% YSZ fused and crushed grades that allow for dense bonded coating layers enabling good adhesion and thermal cycling properties



OUR OFFER

Our main raw materials for performance tools are **largely supplied from our plants** in Germany, France and China. Most common are ZIONIC Zirconia, ALODUR fused Aluminas, Calcined Alumina EVTs and kaolin.

Differences in raw material production are clearly understood and we support every customer to find the most suitable solution, although such may require process adjustments. Intermediates such as Zirconium Oxy Chloride (ZOC) are as well within the scope of our supply. In addition to the raw materials, within Imerys Group we have the ability to offer kiln furnitures for your sintering process step, customised cast and pressed saggars, pressed substrates, inserts as well as pressed, cast or extruded batts for the production of certain performance tools.

Magnesia Zirconias are among the most commonly used materials when excellent corrosion resistance at higher temperatures and thermal shock are needed. The chemical industry uses such structural ceramic components made by injection moulding, extrusion and isostatic (or uniaxial) pressing. Due to this a wide range of MgSZs are needed and allow full optimisation.

We offer a wide range of fused compositions. Addition of MgO during the fusion of the zirconia ensures a perfect homogeneous distribution of the MgO. Especially for larger parts the fused grades are advantageous. We produce a range of fineness, purities and added levels of MgO so you can target optimized thermal shock performance against mechanical performances and wear resistance in the relation with sintering profiles that will help you develop the right grain structure.



SEM picture of a MgSZ raw powder



Cross section of a MgSZ ready to press granule





Spray dried MgSZ (ready to press granule)



Example of one type of arc furnace

Alumina is probably the most widely used material in numerous ceramic applications, whether it is in a pure form or in an alumina containing mineral. We offer various types incl. e.g. 99% fused Alumina under the ALODUR brand. In addition we serve Calcined Alumina EVT, or alumina containing pure minerals such as kaolins and ball clays. Special elaborated alumina based products include ZTA for improved thermal shock resistance and 90-98% alumina bodies as spray dried powders.



Calcined Alumina EVT



Rotary kiln for alumina production

Kaolin used in parts for industrial applications



Spray dryer for ready to press granules

OUR TYPICAL PRODUCTS

		ZIONIC						
		YSZ	MgSZ	CaSZ	Fused ZrO ₂			
Applications	Industrial application	\odot	\odot	\odot	\odot			
	Automotive components	\odot	\odot					
	medical applications	\odot			\odot			
Products	Product category	5% Y Zirconia HP	2.8% MgO Zirconia SP 3.25% MgO Zirconia SP 3.25% MgO Zirconia BP 3.25% MgO Zirconia HP 3.5% MgO Zirconia SP all also as spray dried	5% Ca Zirconia HP spray dried	monoclinic Zirconia SP			
	Size category	-1μm -2μm -5μm	-5µm	-2µm	-5µm			
Basic product information	Fused & crushed type	Ø	\odot					
	Ready to press powder		\odot	\odot				
	Natural mineral							
	Other type							
	Primary crystal size (for Al ₂ O ₃ s) or grain size (for others)							
	Typical soda content							
	0.3 to 2µm	Ø	\odot	\odot	\odot			
	2 to 5µm							
	5 to 10µm							
	>10µm							
	Other							

Others - kiln furniture:

- Silicon Carbide type: ...by covering the full range of RSiC, NSiC and SiSiC
- Cordierite type: ...utilising casting, extrusion and pressing
- Mullite, Alumina and Zirconia types: ...such as supports

			ALODUR®		TECO®	
Chemical ZrO ₂	zoc	Calcined Al ₂ O ₃	Fused Al ₂ O ₃	Tabular Al ₂ O ₃	Fused SiO ₂	Clay
\odot		\odot	\odot	\odot	\odot	\odot
		\odot				
\odot	\odot					
ZRO elec	ZOC 35% ZOC 36%	EVT C620 C786 C795	WRG ZWSK	ALUTAB	TECO-SIL TECO-SIL EMC diverse TECO-SPHERE	RR40
1.5µm 3-5µm		304 404 300 400 500	-48# -325# other	-48# -325# other	-200F -325F other	
		\odot	\odot		\odot	
		\odot				
						\odot
	\odot	\odot		\odot		
		~2.8µm (for 304 and 300) ~4.0µm (for 404 and 400) ~4.9µm (for 500)				
		~0.06%	0.1-0.2% 0.15-0.3%	~0.3%		
\odot						
\odot					\odot	
					\odot	
			\odot	\odot	\odot	
	\odot		\odot	\odot		\odot



THE WORLD'S LEADING PROVIDER OF MINERAL-BASED SPECIALTIES FOR INDUSTRY

Imerys offers high value-added solutions to many different industries, ranging from process manufacturing to consumer goods.

- We provide innovative and quality products to fit with our customers' needs
- We consider Safety as a priority
- We respect the world in which we operate







16,300 employees

At Imerys, we fulfill our role in society in a responsible way.

The technical expertise and innovative mindset of our people enable us to extract and transform minerals responsibly and in a sustainable way over the long term.

For further information, please contact :

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