nanoker

TAKING PROFIT FROM THE SMALL

PRODUCTION

MATERIALS

Alumina, alumina-zirconia, aluminium titanate, mullite, zircon, zirconia etc...

PROCESS

Wet pressing, CIP, slip-casting, unfired machining, after firing machining, assembling, rapid prototyping, spark plasma sintering.

SPECIAL KNOW-HOW

Synthesis of nanopowders, spark plasma sintering (SPS).

USER INDUSTRIES

Automotive, heat treatment; friction, wear protection and corrosion; metal industry; mechanical and chemical process engineering, environmental technology, energy technology, medical technology; luxury goods, etc...

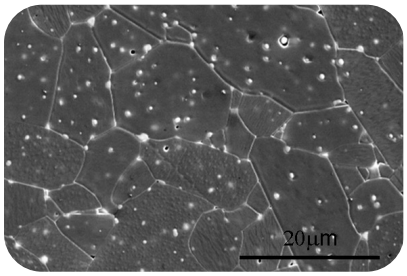
Nanoker is a recently constituted spin-off company (2011) emerging from the Nanomaterials and Nanotechnology Research Center (CINN, Spain). The company operates in the growing and promising field of advanced ceramics for the industry, and its mission consists in bringing to the market new high value added products, based on nanomaterials patented by the CSIC and licensed in exclusivity to Nanoker.

The owners of the company have more than 20 years of experience in the ceramic industry as well as in research & development.

The expertise in the synthesis of nanopowders as well as in the spark plasma sintering process is the main differentiating factor from our competitors.

BRANDS

nanoker



MULTIFUNCTIONAL MATERIALS

DEVELOPMENT OF MULTIFUNCTIONAL MATERIALS FOR DIVERSE SECTORS

DEVELOPMENTS:

Ultra-hard ceramic-metal for cutting tools.
Ultrastable materials with null or low CTE.
Glass-based biocides with/without Ag or Cu.
Others.

CAPACITY:

Prototypes, pre-industrial upscaling.

PATENTS:

WO2011083193 - Composite material having controlled coefficient of thermal expansion with oxidic ceramics and procedure for the obtainment thereof.

WO2011070209 - Powder of vitreous composition having biocidal activity.

keratec

TECHNICAL CERAMICS

MANUFACTURE OF COMPONENTS FOR THE INDUSTRY.

PRODUCTS:

High-pressure waterjet nozzles
Centering and welding pins
Extrusion dies
Laboratory ware
Custom-made products

CAPACITY:

Short-medium series.

PATENTS:

WO2013064713 - Nanostructured composite metal oxide material, production method and use.

bioker

BIOCERAMICS

MANUFACTURE OF CERAMIC BLANKS FOR DENTAL CAD/CAM SYSTEMS

PRODUCTS:

Zirconia disks (white or colour)
Zirconia High Translucency disks (white or colour)
Ce-TZP/Al_2O_3 disks for abutments

CAPACITY:

10.000 to 25.000 units.

PATENTS:

WO2010052359 - Coloured zirconia material, procedure for obtainment and applications thereof.

WO2011015697 - Nanostructured composite material of stabilized zirconia with cerium oxide and doped alumina with zirconia, use and procedure for obtaining same.

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SPARK PLASMA SINTERING CAPABILITIES

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TECHNOLOGY

Spark Plasma Sintering (SPS) is an innovative sintering process that is emerging as a key enabling technology in the processing of numerous materials, such as nanostructured materials, composite materials and gradient materials.

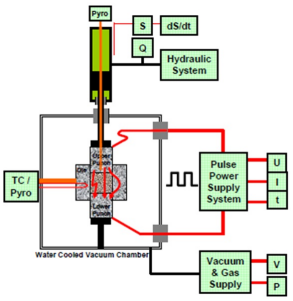


Fig 1. SPS scheme of operation

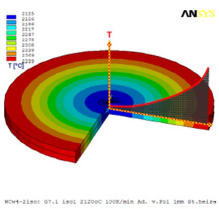


Fig 2. Thermal gradients in large scale samples in SPS

The process is based on a modified hot pressing setup in which an electric current runs directly through the pressing mould (typically graphite) and the component (see figure 1). By means of the pulsed electric current and the "spark plasma effect", **very rapid heating times** and **short process cycles** are achieved.

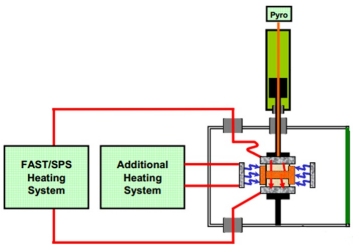


Fig 3. Hybrid SPS-induction machine

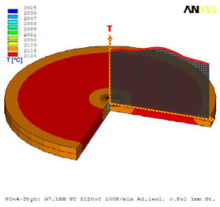


Fig 4. Homogeneous thermal distribution in large scale samples made by hybrid SPS-induction machine

This suppresses granular growth and the achieving of balanced states, **which allows the creation of materials with compositions and properties not obtainable up to now**, materials in the sub-micron or nano-scale and composite materials with unique compositions.

The main drawback of this technology up to now has been the size of the samples to obtain (Ø 250 mm) and its heterogeneity (see figure 2) in large samples due to the thermal gradients generated during the process. Therefore it was a technology mainly conceived for research and development purposes and with a bottleneck in its scalability.

A great breakthrough in this technology has been performed with the manufacturing of a **large scale SPS machine (Ø 400 mm)** that incorporates an additional induction heating process (see figure 3) to reduce thermal gradients and obtain homogeneous materials in an industrialize process (see figure 4).

This machine (HHP400) is owned by CINN-CSIC and has been installed in the facilities of Nanoker Research, owner of the exploitation rights of this technology thanks to a public-private collaboration agreement.

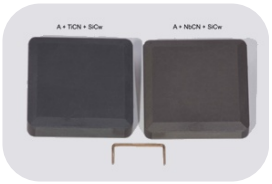
MATERIALS & APPLICATIONS

Nanoker has been working with the following materials for the mentionned applications but other materials such as metals, intermetallic composites, functionally graded materials could be object of further R&D:

Satellite mirrors

Al_2O_3-LAS , LAS-CNF

Very low or tailored CTE, high rigidity, low density, electrical conductivity, oxidation resistance at high temperature, etc.



Cutting tools

Al_2O_3 -Ti (C,N)

Very high fracture strength, high fracture toughness, electrical conductivity, high chemical stability, oxidation resistance at high temperature, etc.

Infrared (IR) windows

Spinel, Al_2O_3

High transmittance, high hardnesss, good corrosion resistance, oxidation resistance at high temperature, etc.

Armour plates

Al_2O_3 -SiC, B_4C

High hardness, high modulus of elasticity, and high relative density, etc...

Thermoelectric generator

HMS, MgSi, PbTe

Thermal and electrical conductivity, functionally graded materials, etc.

Turbine blades

WC, TiC, TiN, Si_3N_4

Extreme hardness, high thermal conductivity, low coefficient of thermal expansion (CTE), electrical conductivity, high corrosion resistance, etc...

R&D PROJECTS

Nanoker is a spin-off the IP Nanoker project and the firm is continuously involved since with strategic partners in **National and European-funded research projects** for the development of new solutions based on SPS technology.

FP6NMP - IP Nanoker (2005-2009):
"Structural ceramic nanocomposites for top end functional applications".

CDTI - Ultradur (2011-2013):
"New products based on ultrahard materials".

FP7 SME - Power Driver (2012-2014):
"Innovative and environmentally friendly thermo-electric power generation system for automotive and marine applications".

FP7 SME - Hymacer (2013-2015):
" Hybrid sintering and non-conventional machining of advanced technical ceramics".

MANUNET - Ceratool (2013-2015):
" Development of ceramic cutting tools based on a hybrid FAST/SPS manufacturing process"

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