

INSTRUCTIONS FOR USE

GQ NANO POWDER

15-45

METAL-CERAMIC ALLOY

Powder, 15-45 µm

GQ Nano Powder is a dental metal-ceramic alloy based on cobalt. The alloy is free from nickel, cadmium, beryllium and lead and fulfils the standards of EN ISO 22674 type 5 for appliances in which parts require the combination of high

stiffness and strength, e.g. thin removable partial dentures, parts with thin cross-sections and clasps. GQ Nano Powder can be used as a partial denture alloy as well as a metal-ceramic alloy.

Composition (m/m)

Co	61.7 %
Cr	27.8 %
W	8.5 %
Si	1.6 %
N, Fe, Mn, Nb	< 1.0 %

Particle size d_i	15-45 µm
Density	8.3 g/cm ³
Vickers hardness	285 HV 10
Linear thermal expansion coefficient 25-500 °C	$14,1 \times 10^{-6} \text{ K}^{-1}$
Linear thermal expansion coefficient 20-600 °C	$14,4 \times 10^{-6} \text{ K}^{-1}$
Highest recommended firing temperature $T_{F, \max}$	980 °C
0,2-% Yield $R_{p0,2}$	1,120 MPa
Modulus of elasticity E	236 GPa
Elongation at break A_5	5 %
Tensile of strength (R_m)	1,200 MPa

Recommendations for Use

Design

The design is carried out with suitable CAD software in consideration of dental rules. Wall thickness after finishing of the object: at least 0.3 mm. Design the connector as strong and high as possible (height: at least 3.5 mm, width: at least 2.5 mm).

SLM-Process

Avoid dust production while opening the powder container, transportation and filling into the SLM system! Use a suitable SLM system for the particle distribution of GQ Nano Powder and carry out the SLM-Process according to the manufacturer's instructions for the SLM system. Non melted powder can be reused but should be sieved with a powder sieve (80 µm) first. Melted powder cannot be reused by e.g. casting.

Shot Peening

Blast the production platform with spherical ceramic material with \varnothing 0.125-0.250 mm and 2.5-3.5 bar until a uniform saturation of the surface is visibly achieved.

Stress Relief Heat Treatment

The heat treatment needs to be carried out in a special furnace under argon atmosphere. Place the production platform in an inert gas box with an argon flow of 1-2 l/min and put the box into the cold furnace. Then:

1. Within 60 min heat up to 850 °C and hold the temperature for 60 min.
2. Let the platform cool down. Open furnace door earliest at 600 °C or lower temperature, remove the inert gas box and stop the argon flow.

Firing of Ceramics

Use commercially available dental ceramics for cobalt based metal alloys with a suitable linear thermal expansion coefficient. Please follow the associated work instructions and cooling schemes given by the ceramic manufacturer.

After the heat treatment and cooling down:

1. Remove restorations from the plate using a band saw, rotating instruments or pliers. Use pliers to remove the rest of the supports. Carbide cutters are recommended for finishing of the object.
2. Sand blast the surface by use of a pencil-blaster with aluminium oxide 100 µm or 250 µm.
3. Ultrasonically clean the frame in distilled water or degrease with ethyl acetate.
4. The oxide firing is optional, to be done at about 960 °C under vacuum for 5 minutes. Always remove the oxide layer after oxide firing by sand blasting with aluminium oxide and degrease again.
NOTE: A clean surface is best to avoid bubbles in ceramics.
5. The opaque is applied on the surface by a first thin wash firing and a second evenly covering opaque layer. Before firing always let the opaque dry for 5–10 minutes at 600 °C.
6. Firing and cooling should be carried out in accordance to the ceramic manufacturer's instructions.
7. After every firing step (dentine bake, build-up and glazing) cooling phase until ca. 750 °C.

Finishing

After firing of the ceramic, polish the frame with suitable grinding and polishing instruments for dental alloys up to high gloss.

Soldering and Welding

Soldering before firing of the frame can be carried out with commercially available solders and high temperature flux. The width of the solder gap should be 0.05–0.2 mm. For welding with a laser use suitable commercially available metal welding wires.

Safety Note

Metal dusts are harmful to health! Avoid dust formation and breathing of dust! Use a dust extractor while handling of powder, finishing and blasting. It is recommended to wear tightly sealed goggles, protective gloves, respiratory protection (FFP3) and dust-resistant protective clothing. Consider allergic hypersensitivities to contents of the alloy. Follow the material safety datasheet. In case of suspected incompatibility with individual elements of this alloy, this should not be used.

Warranty

These application recommendations are based on own experiments and experiences and can therefore only be regarded as guidelines. The dentist or dental technician is responsible for the correct processing of this alloy.

Explanation of symbols

 Medical device

 Article number

 Batch number

 Product UDI Code

 Date of manufacturing (YYYY.MM.DD)

 Manufacturer

 Distributor

 Not for reuse

 Refer to instruction for use

INSTRUCTIONS FOR USE

GQ NANO POWDER

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PARTIAL DENTURE ALLOY

Powder, 15-45 µm

GQ Nano Powder is a dental metal-ceramic alloy based on cobalt. The alloy is free from nickel, cadmium, beryllium and lead and fulfils the standards of EN ISO 22674 type 5 for appliances in which parts require the combination of high

stiffness and strength, e.g. thin removable partial dentures, parts with thin cross-sections and clasps. GQ Nano Powder can be used as a partial denture alloy as well as a metal-ceramic alloy.

Composition (m/m)

Co	61.7 %
Cr	27.8 %
W	8.5 %
Si	1.6 %
N, Fe, Mn, Nb	< 1.0 %

Technical Data (Standard values, manufactured condition)

Particle size d_i	15-45 µm
Density	8.3 g/cm ³
Vickers hardness	285 HV 10
0,2-% Yield strength $R_{p0.2}$	1,120 MPa
Modulus of elasticity E	236 GPa
Elongation at break A_5	5 %
Tensile strength (R_m)	1,200 MPa

Recommendations for Use

Digital Design Modelling

The design is carried out with suitable CAD software in consideration of dental rules. Wall thickness after finishing of the object: at least 0,5 mm.

Base thickness of standard bases: 0.75-0,9 mm and 1.0-1.2 mm for smaller bands or skeletonised frames.

Thickness of lower jaw brackets: 1.8-2.0 × 4.0 × 4.2 mm.

Thickness of transition area from minor connectors to clasps: 1.5 × 2.0 mm.

Thickness of clasp tip: 1.2-1.5 mm.

Round off the areas of transition from minor connectors to clasps and the tips of clasps.

SLM-Process

Avoid dust production while opening the powder container, transportation and filling into the SLM system! Use a suitable SLM system for the particle distribution of GQ Nano Powder and carry out the SLM-Process according to the manufacturer's instructions for the SLM system. Non melted powder can be reused but should be sieved with a powder sieve (80 µm) or ultrasonic sieve (55 µm) first. Melted powder cannot be reused by e.g. casting.

Shot Peening

Blast the production platform with spherical ceramic material with Ø 0.25-0.250 mm and 2.5-3.5 bar until a uniform saturation of the surface is visibly achieved.

Stress Relief Heat Treatment

The heat treatment needs to be carried out in a special furnace under argon atmosphere. Place the production platform in an inert gas box with an argon flow of 1-2 l/min and put the box into the cold furnace. Then:

1. Within 90 min heat up to 1,100 °C and hold the temperature for 60 min.
2. Let the platform cool down. Open furnace door earliest at 600 °C or lower temperature, remove the inert gas box and stop the argon flow.

Treatment of the restoration

After the heat treatment and cooling down:

1. Remove restorations from the plate using a band saw, rotating instruments or pliers. Use pliers to remove the rest of the supports. Carbide cutters are recommended for finishing of the object.
2. Sand blast the surface by use of a pencil-blaster with aluminium oxide 100 µm or 250 µm.
3. Electrolytic polishing with commercial electrolytes in dental polishing units. Cover clamps and fitting parts with covering varnish while polishing.

Finishing

After finishing and fitting smooth the frame with a rubber polisher.

Soldering and Welding

Soldering before firing of the frame can be carried out with commercially available solders and high temperature flux. The width of the solder gap should be 0.05–0.2 mm. For welding with a laser use suitable commercially available metal welding wires.

Safety Note

Metal dusts are harmful to health! Avoid dust formation and breathing of dust! Use a dust extractor while handling of powder, finishing and blasting. It is recommended to wear tightly sealed goggles, protective gloves, respiratory protection (FFP3) and dust-resistant protective clothing. Consider allergic hypersensitivities to contents of the alloy. Follow the material safety datasheet. In case of suspected incompatibility with individual elements of this alloy, this should not be used.

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