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FILENAME

**Usage Guidelines for
Dental Cobalt Chromium Alloy Powder**

Compiled by	Reviewed by	Approved by

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1 Product Name

Cobalt Chromium Alloy Powder

2 Main Technical Indicators

2.1 Physical Indicators

Particle size distribution: 15-45um

Powder flow ability: $\leq 20s/50g$

Powder loose density: $\geq 4.5g/cm^3$

Powder compaction density: $\geq 5.0g/cm^3$

Print density: $8.5 \pm 5\%/cm^3$

The coefficient of linear expansion: $(14.1 \pm 0.5) \times 10^{-6}K^{-1}$

2.2 Chemical Composition

2.2.1 CoCrMoW

Element	Co	Cr	Mo	W	Si	Mn	Ni	Be	Cd	Pb
Content (%)	60-64	24-28	4-6	4-6	0-2	<1	<0.1	<0.02	<0.02	<0.02

2.2.2 CoCrMo


Element	Co	Cr	Mo	W	Si	Mn	Ni	Be	Cd	Pb
Content (%)	62-66	27-30	5-7	0-1	<0.2	<0.3	<0.1	<0.02	<0.02	<0.02

3 Product Unsealing, Storage, and Usage Environment

3.1 Unsealing

Open the packaging and remove the product. Open the hot melt seal and be careful not to damage packaging materials such as bottles, caps, etc. as much as possible. Convenient for storing unfinished powder again.

3.2 Storage and use

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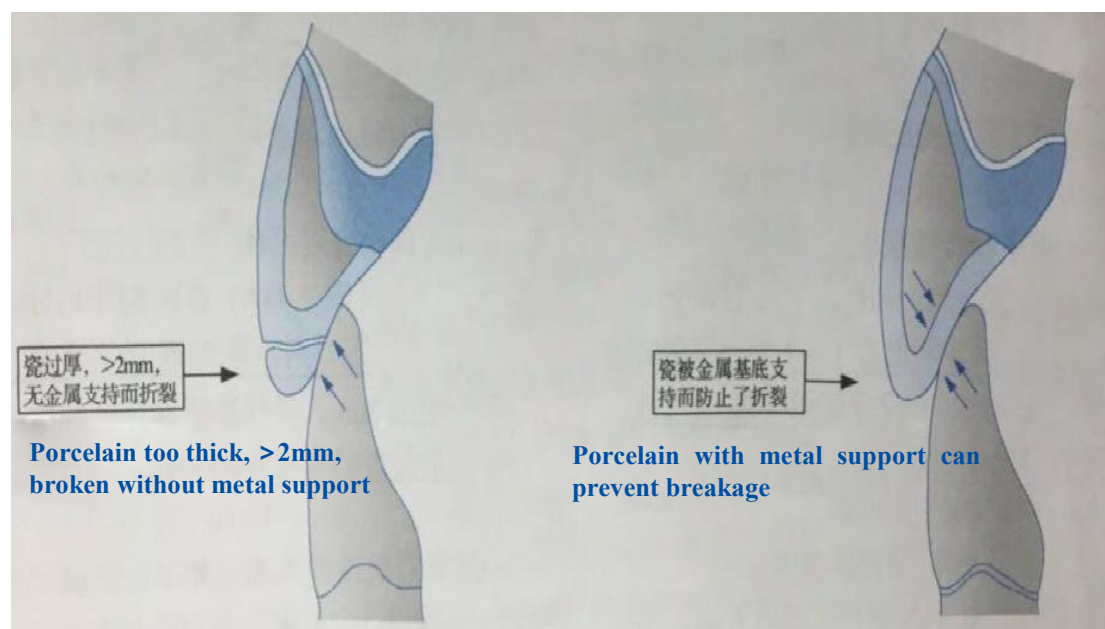
Room temperature environment (without freezing), relative humidity $\leq 50\%$ (without condensation), free from corrosive gases and strong sunlight, and well ventilated indoor environment. Products that have not been used up after opening should be kept intact and well sealed to prevent moisture during storage.

3.3 Transportation


The product needs to avoid impact and heavy pressure.

4 Design

- 1) The thickness of the thinnest part of the inner crown should not be less than 0.3mm (nor too thick to prevent excessive polishing from affecting efficiency and product quality), and the overall design thickness of the crown should not be less than 0.4mm.
- 2) The thickness of the ceramic layer on the tooth tip or cutting end should not be greater than 2mm. If it exceeds 2mm, the ceramic layer will not be supported by the metal substrate and is more prone to cracking.



- 3) Supports, snap rings, and other movable restorations need to be designed and manufactured based on the actual situation of the model.

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5 Selective Laser Melting

5.1 Parameters

SN	Project	Parameters	Note
1	Process	SLM	1. The specific parameters should be adjusted appropriately in conjunction with the equipment's user manual. 2. The necessary maintenance of the equipment should be carried out according to the instructions. 3. The use of contaminated powder is prohibited.
2	Oxygen Content	$\leq 1000\text{PPM}$	
3	Laser Power	100-200W	
4	Diameter of Light Beam	30-60um	
5	Scan Spacing	0.07-0.12mm	
6	Powder Spreading Thickness	30-40um	
7	Scanning Speed	600-1200mm/s	

5.2 Screening

The powder after printing and molding needs to undergo necessary screening treatment to remove impurities and oversized powder particles in the powder before it can be recycled.


5.2.1 Specification of sieve

Use a 250 mesh sieve for the crown and a 200 mesh sieve for the bracket.

5.2.2 Precautions

- 1) During the entire screening process, it is necessary to ensure that the sieve used is free from damage, obvious deformation, and foreign object adhesion.
- 2) Do not apply force directly with sharp objects such as screwdrivers or iron spoons to prevent damage to the screen.

5.2.3 Equipment recommendations

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Vibrating screen powder machine



Industrial vibrating screen

5.3 Powder drying

Powder needs to be dried before printing, otherwise the powder may agglomerate and harden. The fluidity and stacking performance of the powder can also be reduced, and in severe cases, it may affect the quality of the formed parts.

Therefore, it is necessary to dry the powder to improve its physical properties. The precautions for drying are as follows.


- 1) Suggested temperature: 120 °C , bake for 2 hours. After the drying time, the powder should naturally cool in a sealed state. Avoid direct contact with cold air during cooling.
- 2) Suggested equipment: drying oven, electric oven, etc. Ensure that the interior of the oven or furnace is clean and free of foreign objects.

5.4 Powder residue cleaning

After printing, the residual powder inside the crown or bracket cannot be completely removed after powder cleaning. It is necessary to use an air gun to clean the residual powder at a pressure of 0.4-0.6Mpa.

6 Stress Relieving Heat Treatment

6.1 CoCrMoW (internal crown porcelain)

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Segment	Number	Note
C01	20 (room temperature)	1. C: Temperature; T: Time. 2. Crown annealing process: Take the parts after furnace cooling to below 500 °C or after complete cooling. 3. The annealing furnace needs to have a vacuum pumping function. 4. The total heat treatment time is expected to be 3-4 hours. 5. Please refer to the equipment manual for specific operation methods.
T01	60	
C02	950	
T02	60	
C03	950	
T03	-121	

6.2 CoCrMoW (support clamping ring)

Segment	Number	Note
C01	20 (room temperature)	1. C: Temperature; T: Time. 2. Support annealing process: When the furnace is cooled to around 900 °C, open the furnace door and immediately take the parts or cool them to below 500 °C. 3. The annealing furnace needs to have a vacuum pumping function. 4. The total heat treatment time is expected to be 3-4 hours. 5. Please refer to the equipment manual for specific operation methods.
T01	75	
C02	1150	
T02	60	
C03	1150	
T03	-121	

6.2 CoCrMo (support clamping ring)

Segment	Number	Note
C01	20 (room temperature)	1. C: Temperature; T: Time. 2. Support annealing process: Take the parts when cooled to below 500 °C in the furnace, or take the parts when cooled to 900 °C in the furnace.
T01	65	
C02	1050	

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T02	60	3. The annealing furnace needs to have a vacuum pumping function.
C03	1050	
T03	-121	5. Please refer to the equipment manual for specific operation methods.

7 Slicing

7.1 Cutting method

Use a small sawing machine or wire cutting equipment for cutting.



Small sawing machine




Wire cutting equipment

7.2 Precautions

Prevent materials from being contaminated by oil.

8 Lathe Grinding

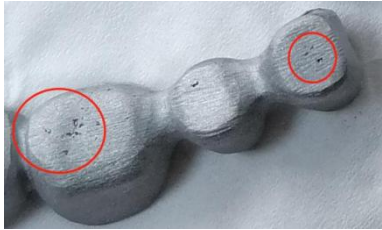

SN	Project	Standard	Application
1	Tools	Dental professional hand grinder	dental crown
2	Grinding Head	Silicon carbide, tungsten steel, gold steel sand	dental crown &. bracket
3	Polishing Machine	Polishing for cobalt chromium brackets	bracket


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4	High Frequency Grinding Machine	Used for dedicated polishing of brackets	bracket
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The thickness of the thinnest part of the tooth crown after polishing shall not be less than 0.3mm.

9 Sand Blast


SN	Project	Standard	Application
1	Sandblasting Machine	Pen sandblasting machine	dental crown
2	Sand	80-120 mesh alumina sand	
3	Pressure	0.4-0.6Mpa	
4	Operation Details	Tilt angle: 45° Distance: 1-2cm Nozzle Aperture: ϕ 1-2mm	
5	Acceptance Criteria	The porcelain surface must be round without diamond corners, shrinkage holes, or dead corners.	
6	ATTENTION	After sandblasting, do not directly touch the crown with your hands.	
7	<p>★After sandblasting, check the surface of the dental crown for support residues and sharp angles. If found, it needs to be re polished.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Incomplete polishing</p> </div> <div style="text-align: center;">  <p>Sharp corner residue</p> </div> </div>		

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.10 Clean

The second and third steps in the cleaning process can be used simultaneously, or they can be cleaned separately according to the situation. It is recommended to use it step by step to ensure thorough cleaning.

Stage	Project	Method	Acceptance Criteria
1	Tap-water	Wash repeatedly	No obvious aluminum oxide sand or visible foreign object adhesion on the surface of the restoration
2	Ultrasonic	Shake and clean with water or alcohol for 3-5 minutes	No sediment in the vibrator
3	Vapor	Filtered water vapor (do not use tap water vapor for direct cleaning)	No sediment and alcohol in the vibrator
4	Dry by airing	Air dry naturally or blow dry with cold air or dry on a porcelain stove	No water stains on the metal surface

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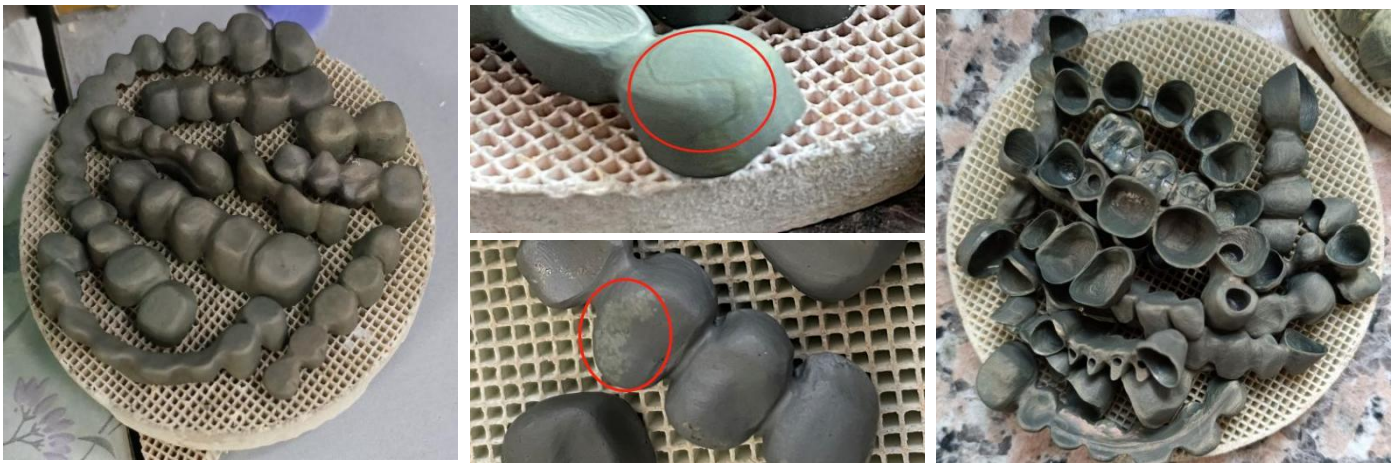
11 Preoxidation

11.1 Recommended sintering parameters

Taking the Porcelain Oven of Lorraine as an Example.

Preheat Temperature	Drying Time	Warm-up Time	Heating Rate	Firing Temperature	Firing Time	Cooling Time	Vacuum Start	Vacuum Value	Vacuum Stop	Vacuum Time
550°C	90s	90s	70°C/min	980°C	60s	120	550	95	980	0


11.2 State after preoxidation



Normal state

Water stains residue

Incorrect stacking arrangement

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12 Apply Bonding Layer WO

The bonding layer, also known as the metal ceramic bond, can increase the bonding ability of the metal ceramic. Apply a thin layer on the surface of the metal substrate.

12.1 Recommended sintering parameters

Taking the Porcelain Oven of Lorraine as an Example.

Preheat Temperature	Drying Time	Warm-up Time	Heating Rate	Firing Temperature	Firing Time	Cooling Time	Vacuum Start	Vacuum Value	Vacuum Stop	Vacuum Time
550°C	240s	180s	60°C/min	980°C	60s	240	550	95	980	0

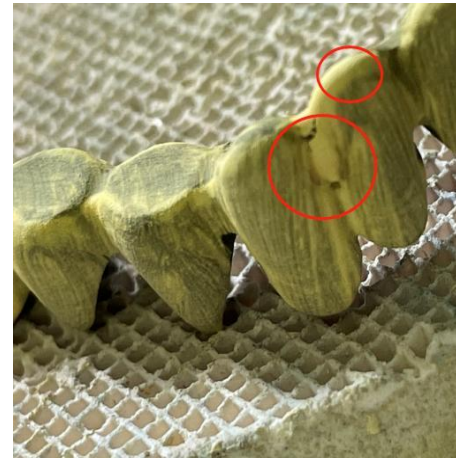
12.2 State after pre oxidation




Normal state



Normal baking



Laying too thick

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13 Coated Opaque Porcelain (OP)

Taking the Porcelain Oven of Lorraine as an Example.

The baking parameters for the two layer shading layer are as follows.

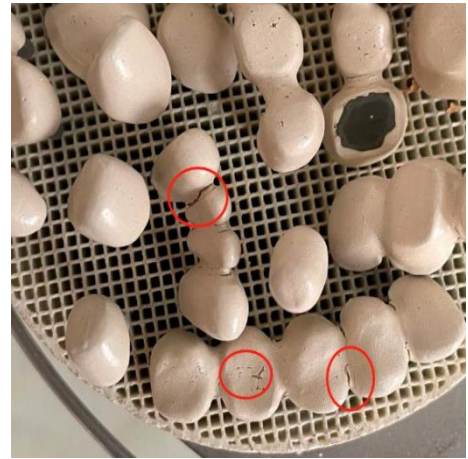
Preheat Temperature	Drying Time	Warm-up Time	Heating Rate	Firing Temperature	Firing Time	Cooling Time	Vacuum Start	Vacuum Value	Vacuum Stop	Vacuum Time
550°C	180s	180s	55°C/min	950°C	60s	240	550	95	950	0




Normal OP first layer



Normal OP second layer



Severe cracking at individual locations after baking, requiring repair

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14 Upper Porcelain

Taking the Porcelain Oven of Lorraine as an Example.

The recommended baking parameters for the first layer of porcelain are as follows.

Preheat Temperature	Drying Time	Warm-up Time	Heating Rate	Firing Temperature	Firing Time	Cooling Time	Vacuum Start	Vacuum Value	Vacuum Stop	Vacuum Time
550°C	240s	180s	55°C/min	925°C	60s	240	550	95	925	0



Before baking



After baking

The recommended baking parameters for the second layer of porcelain are as follows.


Preheat Temperature	Drying Time	Warm-up Time	Heating Rate	Firing Temperature	Firing Time	Cooling Time	Vacuum Start	Vacuum Value	Vacuum Stop	Vacuum Time
550°C	240s	180s	55°C/min	920°C	60s	240	550	95	920	0



Before baking



After baking

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15 Porcelain Processing

Avoid grinding needles staying in the same position for a long time during porcelain processing, which can cause the porcelain layer to overheat and crack.



After porcelain processing



After cleaning

16 Glazing

Taking the Porcelain Oven of Lorraine as an Example.

The glaze baking parameters are as follows.

Preheat Temperature	Drying Time	Warm-up Time	Heating Rate	Firing Temperature	Firing Time	Cooling Time	Vacuum Start	Vacuum Value	Vacuum Stop	Vacuum Time
550°C	180s	180s	55°C/min	900°C	60s	240	550	/	/	0

