

TruPrint 2000 Cobalt-Chrome



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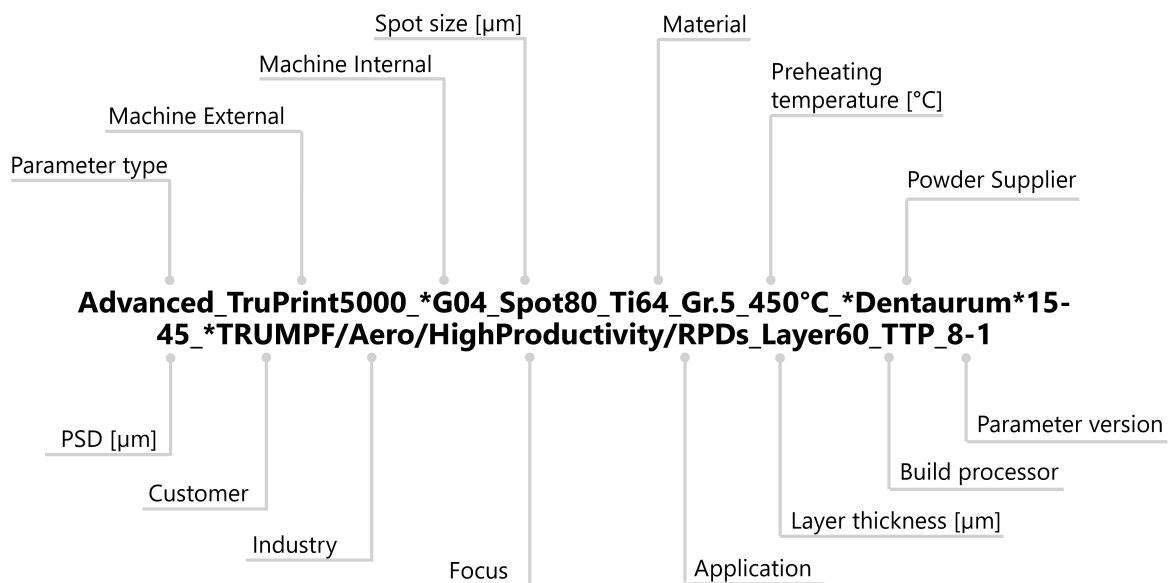
1. Introduction to parameters at TRUMPF AM

This document details the parameter set for processing Cobalt-Chrome using the TruPrint 2000. The set encompasses all materials within this material group, various layer thicknesses, and types of data preparation software. TRUMPF recommends using TruTops Print for data preparation. Each set may include basic and advanced parameters. Basic parameters are intended as a starting point for development. They are suitable for test geometries, but are generally not recommended for direct part production. Advanced parameters are refined settings suitable for actual component production.

Additionally, the document provides detailed information about the powders used to develop these parameters. Other powders, similar to those mentioned, are also suitable for production on our systems.

We are happy to assist you further in parameter development and optimization to meet your part requirements. Please reach out to us for support.

How do parameter names work at TRUMPF Additive Manufacturing?



*optional possibilities to differ the parameter portfolio

2. Available Parameters

Material	Machine	Parameter type ¹	Spot [μm]	Preheating temperature ² [°C]	Layer thickness [mm]	Build processor ³	Build rate ⁴ [cm ³ /h]
CoCrMo	G05	Basic	55	23	0.02	Mat	15.0
CoCrW	G05	Advanced	55	23	0.02	TTP	15.9
CoCrW	G05	Basic	55	23	0.02	OQT	15.9
CoCrW	G05	Basic	55	23	0.03	TTP	22.7
CoCrW	G05	Basic	55	23	0.02	OQT	15.9
CoCrW	G05	Basic	55	23	0.03	TTP OQT	20.7
CoCrW	G05	Basic	55	23	0.03	OQT	22.7
CoCrWMo	G05	Advanced	55	23	0.03	OQT	20.7
CoCrWMo	G05	Advanced	55	23	0.02	OQT	15.9
CoCrWMo	G05	Basic	55	23	0.02	OQT	15.9
CoCrWMo	G05	Basic	55	23	0.03	OQT	20.7
CoCrWMo	G05	Basic	55	23	0.02	TTP	15.0
CoCrWMo	G05	Basic	55	23	0.02	OQT	15.9
CoCrWMo	G05	Basic	55	23	0.03	OQT	20.7
CoCrWMo	G05	Basic	55	23	0.02	TTP	15.1

3. Powder Information

Please contact additive.manufacturing@de.trumpf.com for direct contact to powder manufacturers.

Material	Supplier	Powder name	PSD [μm]	Supplier ID
CoCrMo	Oerlikon Metco	CoCr-B-LMF	15-45	CoCr-B-LMF
CoCrW	Dentaurum	Remanium® star powder	10-30	REF 102-620-70
CoCrWMo	ADOR	Adorbond CC Plus	10-30	7625.0
CoCrWMo	BEGO	Mediloy® S-Co	10-45	50551.0

4. Parameter details

4.1. Basic_TruPrint2000_Spot55_CoCrMo_Oerlikon_Tech_Layer20

Powder information		Material properties	
Material	CoCrMo	Build rate⁴ [cm³/h]	15.0
Supplier	Oerlikon Metco	Relative density⁵ [%]	99.7
Powder name	CoCr-B-LMF	Average roughness⁶ R_a [μm]	—
Supplier ID	CoCr-B-LMF	Average roughness⁶ R_z [μm]	—

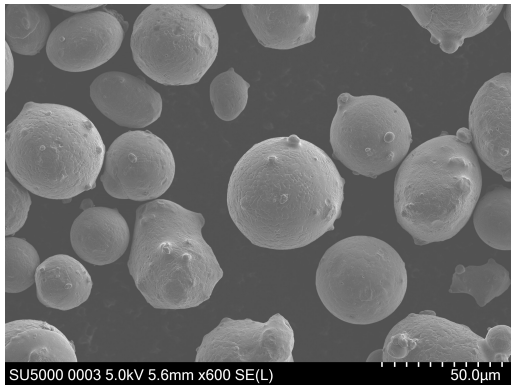


Figure 1: CoCrMo powder by Oerlikon Metco.
PSD: 15-45 μm. SEM magnification:
600x.

4.2. Advanced_TruPrint2000_Spot55_CoCrW_Dentaurum_Layer20

Powder information		Material properties	
Material	CoCrW	Build rate⁴ [cm³/h]	15.9
Supplier	Dentaurum	Relative density⁵ [%]	99.7
Powder name	Remanium® star powder	Average roughness⁶ R_a [μm]	5.4
Supplier ID	REF 102-620-70	Average roughness⁶ R_z [μm]	32.5

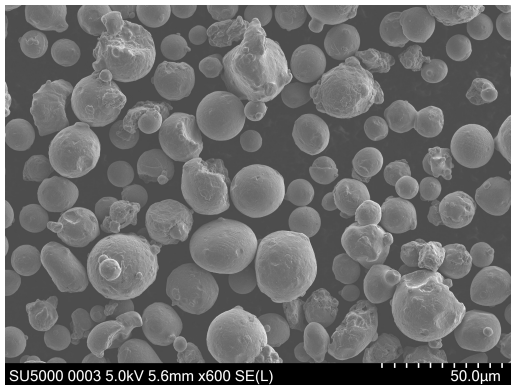


Figure 2: CoCrW powder by Dentaurum. PSD: 10-30 μm. SEM magnification: 600x.

No Heat Treatment

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Mechanical properties ⁹ machined				
	0°	90°	Average ¹²	
Yield strength [MPa]	912.0 – 948.0	649.0 – 769.0	—	Samples —
Tensile strength [MPa]	1256.0 – 1280.0	1153.0 – 1213.0	—	Build jobs —
Elong. at break [%]	9.0 – 11.4	10.0 – 22.0	—	Machines —

Hardness ¹³	
Vickers [HV]	381.0 – 441.0

Physical properties	
Electrical conductivity [%IACS]	0.6 – 1.8
Thermal conductivity¹⁴ [W/mK]	5.0

CoCrW: Dentaurum_Remanium_Star_L_Air

Process description⁷: 1100°C/0,75h,Air

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Mechanical properties⁹ machined				
	0°	90°	Average¹²	
Yield strength [MPa]	835.0 – 985.0	824.0 – 872.0	—	Samples —
Tensile strength [MPa]	1221.0 – 1389.0	1203.0 – 1257.0	—	Build jobs —
Elong. at break [%]	4.6 – 6.4	9.2 – 15.2	—	Machines —

Hardness¹³	
Vickers [HV]	420.0 – 468.0

CoCrW: Dentaurum_Remanium_Star_L

Process description⁷: 1100°C/0,75h,Ar

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Mechanical properties⁹ machined				
	0°	90°	Average¹²	
Yield strength [MPa]	—	823.0 – 913.0	—	Samples —
Tensile strength [MPa]	—	1209.0 – 1335.0	—	Build jobs —
Elong. at break [%]	—	11.1 – 17.1	—	Machines —

Hardness¹³	
Vickers [HV]	390.0 – 462.0

Physical properties	
Electrical conductivity [%IACS]	0.8 – 2.0
Thermal conductivity¹⁴ [W/mK]	5.0

4.3. Basic_TruPrint2000_Spot55_CoCrW_Dentaurum_C&B_Layer20

Note for further use of the parameter ¹⁵

Powder information		Material properties	
Material	CoCrW	Build rate⁴ [cm³/h]	15.9
Supplier	Dentaurum	Relative density⁵ [%]	99.7
Powder name	Remanium® star powder	Average roughness⁶ R_a [μm]	—
Supplier ID	REF 102-620-70	Average roughness⁶ R_z [μm]	—

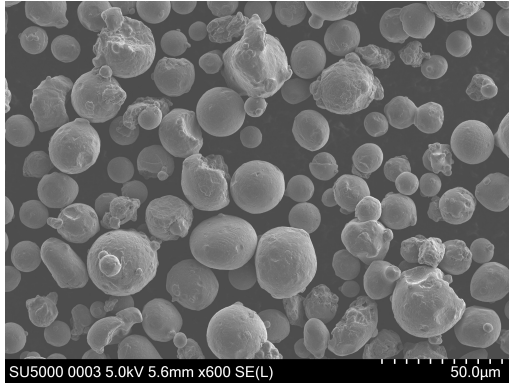


Figure 3: CoCrW powder by Dentaurum. PSD: 10-30 μm. SEM magnification: 600x.

4.4. Basic_TruPrint2000_Spot55_CoCrW_Dentaurum_C&B_Layer30

Note for further use of the parameter ¹⁵

Powder information		Material properties	
Material	CoCrW	Build rate⁴ [cm³/h]	22.7
Supplier	Dentaurum	Relative density⁵ [%]	99.8
Powder name	Remanium® star powder	Average roughness⁶ R_a [μm]	—
Supplier ID	REF 102-620-70	Average roughness⁶ R_z [μm]	—

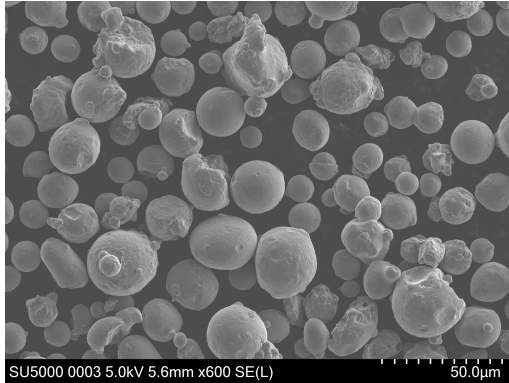


Figure 4: CoCrW powder by Dentaurum. PSD: 10-30 μm. SEM magnification: 600x.

No Heat Treatment

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Mechanical properties ⁹ machined				
	0°	90°	Average ¹²	
Yield strength [MPa]	—	593.0 – 665.0	—	Samples —
Tensile strength [MPa]	—	1132.0 – 1150.0	—	Build jobs —
Elong. at break [%]	—	13.8 – 19.8	—	Machines —

Physical properties	
Electrical conductivity [%IACS]	0.6 – 1.8
Thermal conductivity¹⁴ [W/mK]	5.0

4.5. Basic_TruPrint2000_Spot55_CoCrW_Dentaurum_RPDs_Layer20

Powder information		Material properties	
Material	CoCrW	Build rate⁴ [cm³/h]	15.9
Supplier	Dentaurum	Relative density⁵ [%]	99.7
Powder name	Remanium® star powder	Average roughness⁶ R_a [μm]	—
Supplier ID	REF 102-620-70	Average roughness⁶ R_z [μm]	—

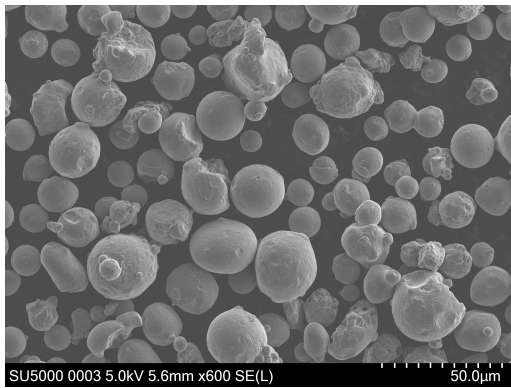


Figure 5: CoCrW powder by Dentaurum. PSD: 10-30 μm. SEM magnification: 600x.

No Heat Treatment

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Physical properties	
Electrical conductivity [%IACS]	0.6 – 1.8
Thermal conductivity¹⁴ [W/mK]	5.0

4.6. Basic_TruPrint2000_Spot55_CoCrW_Dentaurum_RPDs_Layer30

Powder information		Material properties	
Material	CoCrW	Build rate⁴ [cm³/h]	20.7
Supplier	Dentaurum	Relative density⁵ [%]	99.7
Powder name	Remanium® star powder	Average roughness⁶ R_a [μm]	—
Supplier ID	REF 102-620-70	Average roughness⁶ R_z [μm]	—

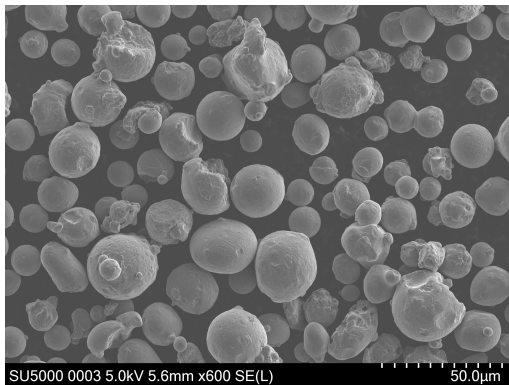


Figure 6: CoCrW powder by Dentaurum. PSD: 10-30 μm. SEM magnification: 600x.

No Heat Treatment

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Mechanical properties ⁹ machined				
	0°	90°	Average ¹²	
Yield strength [MPa]	—	593.0 – 665.0	—	Samples —
Tensile strength [MPa]	—	1132.0 – 1150.0	—	Build jobs —
Elong. at break [%]	—	13.8 – 19.8	—	Machines —

Physical properties	
Electrical conductivity [%IACS]	0.6 – 1.8
Thermal conductivity¹⁴ [W/mK]	5.0

4.7. Basic_TruPrint200_Spot55_CoCrW_Dentaurum_C&B_Layer30

Note for further use of the parameter ¹⁵

Powder information		Material properties	
Material	CoCrW	Build rate⁴ [cm³/h]	22.7
Supplier	Dentaurum	Relative density⁵ [%]	99.7
Powder name	Remanium® star powder	Average roughness⁶ R_a [μm]	—
Supplier ID	REF 102-620-70	Average roughness⁶ R_z [μm]	—

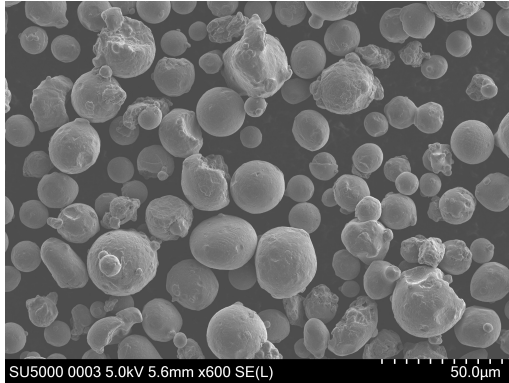


Figure 7: CoCrW powder by Dentaurum. PSD: 10-30 μm. SEM magnification: 600x.

No Heat Treatment

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Physical properties	
Electrical conductivity [%IACS]	0.6 – 1.8
Thermal conductivity¹⁴ [W/mK]	5.0

4.8. Advanced_TruParam2000_Spot55_CoCrWMo_Ador_Layer30

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	20.7
Supplier	ADOR	Relative density⁵ [%]	99.7
Powder name	Adorbond CC Plus	Average roughness⁶ R_a [μm]	—
Supplier ID	7625.0	Average roughness⁶ R_z [μm]	—

4.9. Advanced_TruPrint2000_Spot55_CoCrWMo_Bego_Layer20

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	15.9
Supplier	BEGO	Relative density⁵ [%]	99.7
Powder name	Mediloy® S-Co	Average roughness⁶ R_a [μm]	4.5
Supplier ID	50551.0	Average roughness⁶ R_z [μm]	24.8

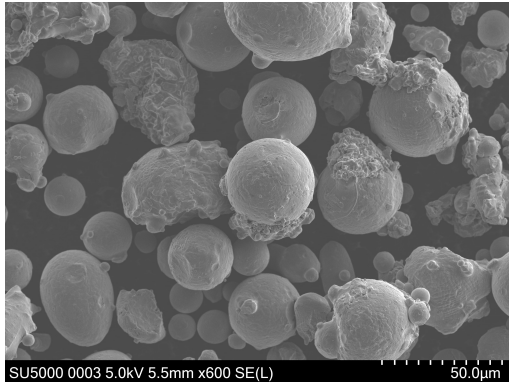


Figure 8: CoCrWMo powder by BEGO. PSD: 10-45 μm. SEM magnification: 600x.

No Heat Treatment

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Mechanical properties ⁹ machined				
	0°	90°	Average ¹²	
Yield strength [MPa]	769.0 – 811.0	563.0 – 593.0	—	Samples —
Tensile strength [MPa]	1253.0 – 1295.0	1125.0 – 1179.0	—	Build jobs —
Elong. at break [%]	10.0 – 16.0	18.8 – 27.2	—	Machines —

Hardness ¹³	
Vickers [HV]	350.0 – 428.0

CoCrWMo: Bego_Mediloy_S-Co_S

Process description⁷: 800°C/0,25h,Air

All properties are reported using 3σ -intervals⁸. The values for 0° and 90° are derived from qualification reports, while the average values are calculated from additional measurements.

Mechanical properties⁹ machined				
	0°	90°	Average¹²	
Yield strength [MPa]	1155.0 – 1185.0	970.0 – 976.0	—	Samples —
Tensile strength [MPa]	1416.0 – 1470.0	1190.0 – 1244.0	—	Build jobs —
Elong. at break [%]	5.0 – 11.0	8.0 – 20.0	—	Machines —
Hardness¹³				
Vickers [HV]	449.0 – 551.0			

4.10. Basic_TruPrint2000_Spot55_CoCrWMo_Ador_C&B_Layer20

Note for further use of the parameter ¹⁵

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	15.9
Supplier	ADOR	Relative density⁵ [%]	99.5
Powder name	Adorbond CC Plus	Average roughness⁶ R_a [μm]	—
Supplier ID	7625.0	Average roughness⁶ R_z [μm]	—

4.11. Basic_TruPrint2000_Spot55_CoCrWMo_Ador_C&B_Layer30

Note for further use of the parameter ¹⁵

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	20.7
Supplier	ADOR	Relative density⁵ [%]	99.5
Powder name	Adorbond CC Plus	Average roughness⁶ R_a [μm]	—
Supplier ID	7625.0	Average roughness⁶ R_z [μm]	—

4.12. Basic_TruPrint2000_Spot55_CoCrWMo_Ador_Tech_Layer20

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	15.0
Supplier	ADOR	Relative density⁵ [%]	99.7
Powder name	Adorbond CC Plus	Average roughness⁶ R_a [μm]	—
Supplier ID	7625.0	Average roughness⁶ R_z [μm]	—

4.13. Basic_TruPrint2000_Spot55_CoCrWMo_Bego_C&B_Layer20

Note for further use of the parameter ¹⁵

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	15.9
Supplier	BEGO	Relative density⁵ [%]	99.7
Powder name	Mediloy® S-Co	Average roughness⁶ R_a [μm]	—
Supplier ID	50551.0	Average roughness⁶ R_z [μm]	—

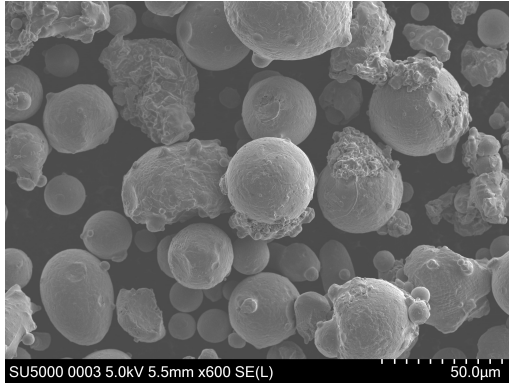


Figure 9: CoCrWMo powder by BEGO. PSD:
10-45 μm. SEM magnification: 600x.

4.14. Basic_TruPrint2000_Spot55_CoCrWMo_Bego_C&B_Layer30

Note for further use of the parameter ¹⁵

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	20.7
Supplier	BEGO	Relative density⁵ [%]	99.5
Powder name	Mediloy® S-Co	Average roughness⁶ R_a [μm]	—
Supplier ID	50551.0	Average roughness⁶ R_z [μm]	—

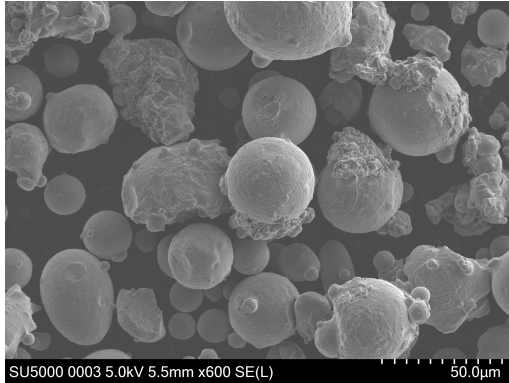


Figure 10: CoCrWMo powder by BEGO. PSD: 10-45 μm. SEM magnification: 600x.

4.15. Basic_TruPrint2000_Spot55_CoCrWMo_Bego_Layer20

Powder information		Material properties	
Material	CoCrWMo	Build rate⁴ [cm³/h]	15.1
Supplier	BEGO	Relative density⁵ [%]	99.7
Powder name	Mediloy® S-Co	Average roughness⁶ R_a [μm]	—
Supplier ID	50551.0	Average roughness⁶ R_z [μm]	—

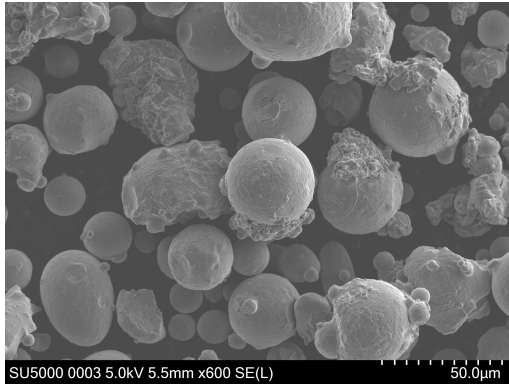


Figure 11: CoCrWMo powder by BEGO. PSD: 10-45 μm. SEM magnification: 600x.

- ¹ Basic parameters: starting point for development, generally not recommended for direct part production.
Advanced parameters: refined settings, suitable for actual component production.
- ² Describes the preheating temperature of the build plate. A generic value of 23°C is stated, if no active preheating was used. The actual value depends on the climatic conditions of the surrounding.
- ³ TTP: TruTops Print, Mat: Materialise, Cam: Cambridge, Oqt: Oqton
- ⁴ Calculated melting rate with maximum amount of lasers; effective melting rate may differ depending on the application.
- ⁵ ASTM E 1245:2003. Measurement of the relative density was performed for specimens with cubic geometries. Values can differ for other geometries and sizes.
- ⁶ According to DIN EN ISO 21920-2-01:2022 with used measurement length of 4,8 mm
- ⁷ The process description is read as follows: Example: 650°C/10min,850°C/10min,1010°C/30min,Air; 590°C/2h,Air; 590°C/2h,Air: 1. Heat treatment cycle: (1. temperature/1. holding time at temperature, 2. temperature/2. holding time, quenching medium); 2. heat treatment cycle (temperature/holding time, quenching medium); 3. heat treatment cycle (temperature/holding time, quenching medium). We recommend that titanium is heat treated under vacuum.
- ⁸ Values are stated as intervals from 3σ to the left of the mean to 3σ to the right of the mean. This ensures that, statistically, 99.73% of the process output meets customer requirements. For sufficiently many data points, a full process capability analysis was performed and intervals are stated such that a CPK of 1.33 was achieved.
- ⁹ DIN EN ISO 6892-1:2017, DIN 50125:2016
- ¹⁰ DIN EN ISO 22674
- ¹¹ ASTM E8
- ¹² The average values could include a combination of different build jobs on the same machine type, different powder manufacturers and different inspection orientations.
- ¹³ DIN EN ISO 6506-1:2015
- ¹⁴ Calculated from electrical conductivity using Wiedemann Franz Law: $\kappa/\sigma = LT$, with thermal conductivity κ [W/mK], electrical conductivity σ [S/m], Lorenz number $L = 2.44 \cdot 10^{-8} \text{ W}\Omega/\text{K}^2$, temperature T [K].
- ¹⁵ C&B parameters are especially tested for the needs of dental Crowns & Bridges applications. Nonetheless, they are developed in a way that they can be considered for wider use, including other dental applications. In any case, the powder manufacturer's datasheet and instructions for use must be checked to ensure the right material is used for the intended application.

Further test procedure details are available on request.

The component properties obtained were exclusively derived from the combination of suitable powder, the TRUMPF TruPrint and the parameter sets, while observing the current operator's manual.

The data in this technical data sheet and other information are up to date. They alone do not provide a sufficient basis for designing components. The suitability of a component for a particular application cannot be guaranteed by this information. The details in this data sheet are intended exclusively for information purposes and do not constitute an agreement on certain qualities. The TRUMPF warranty only covers agreements specified in the delivery contracts.

The manufacturer of a component is responsible for determining the properties and suitability for any use of the component. They are also responsible for respecting any potential property rights and current legislation and regulations.

As a result of continuous improvement processes in place at TRUMPF, the information in this data sheet is subject to change without prior notice. Errors are excepted.