



WOLFRAM INDUSTRIE
TUNGSTEN TECHNOLOGY GROUP

TRIAMET® Tungsten-based heavy metals – we make more out of them for you.

We develop, produce and test, what others only sell.

- 1** Tungsten-based heavy metals with production expertise
- 2** Innovative solutions for individual demands
- 3** Oversizes and special sizes deliverable on short notice
- 4** More diameter – never average
- 5** Diversity is our standard

TRIAMET® tungsten-based heavy metals – as individually developed as needed.

Unlike most suppliers, we are not only the distributors but also the manufacturers of our products. We develop and produce metallurgically superior and technically intelligent solutions from tungsten in Germany – and have been doing so for over 100 years. Our knowledge, expertise and experience make us

the ideal partner, especially if you have specific and individual requirements for a heavy metal from tungsten-based materials. We develop our TRIAMET® products for innovative customer- and application orientated solution, starting from a batch size of one up.

The production – made more competent through experience.

TRIAMET® heavy metals are made from high-quality raw powders that are mixed and pressed in appropriate combinations. Depending on the pressing process and compression pressure, the blanks already exhibit up to 80 % of their final density. This end density is then reached during a liquid phase sintering at high temperatures, after which the sintered blanks can be brought to the final dimensions you require through further mechanical processing.

Quality assurance – reliable from experience.

Through regular checks before, during and after the production, we guarantee the high quality standard of our products. This allows us to guarantee that you receive products and services that precisely meet your specifications and generally valid quality demands.

Forms of delivery – more flexible from experience.

Our customers have one thing in common: none is like the other. This is also true for our forms of delivery. Therefore, we offer, according to your drawings, completely made fittings and semi-finished products that suit your processes in the form of bars, slabs and blocks. We also provide blanks on short notice in extra-long and special sizes.

From raw material to material – only those who master the entire process can deliver more than the standard:



Metal powder



Mixing



Press



Sinter



Reshape



Heat treatment



Process, Mate,
Coat



Quality assurance



Qualities and characteristics of the TRIAMET® – heavy metals

All TRIAMET® heavy metals are composite tungsten-based materials. The individual tungsten crystals here are not (as they are with pure tungsten metal) directly connected to the grain boundaries, but through a metallic bonding phase.

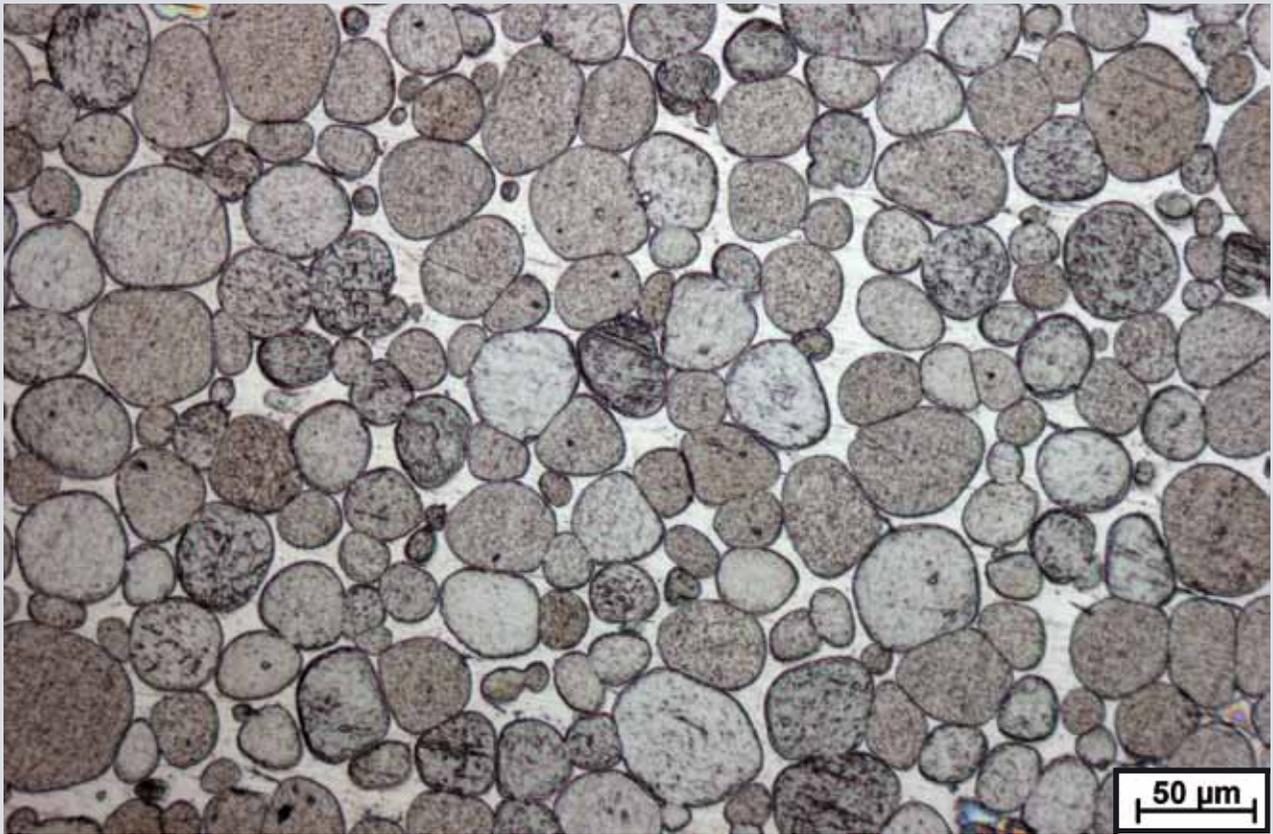
The shape of the tungsten grain and the formation of the binders mainly depend on the temperature control during the sintering cycle. You and the binder content decide on the physical and technological properties of the heavy metal as well as its behavior in practice.

The density of a pore-free heavy metal is limited only by the proportion of the bonding phase. The lower the percentage, the higher the density, up to a limit value near 19.0 g/cm^3 . With increasing binder content, on the other hand, the ductility of the heavy metal increases. The same is true for the

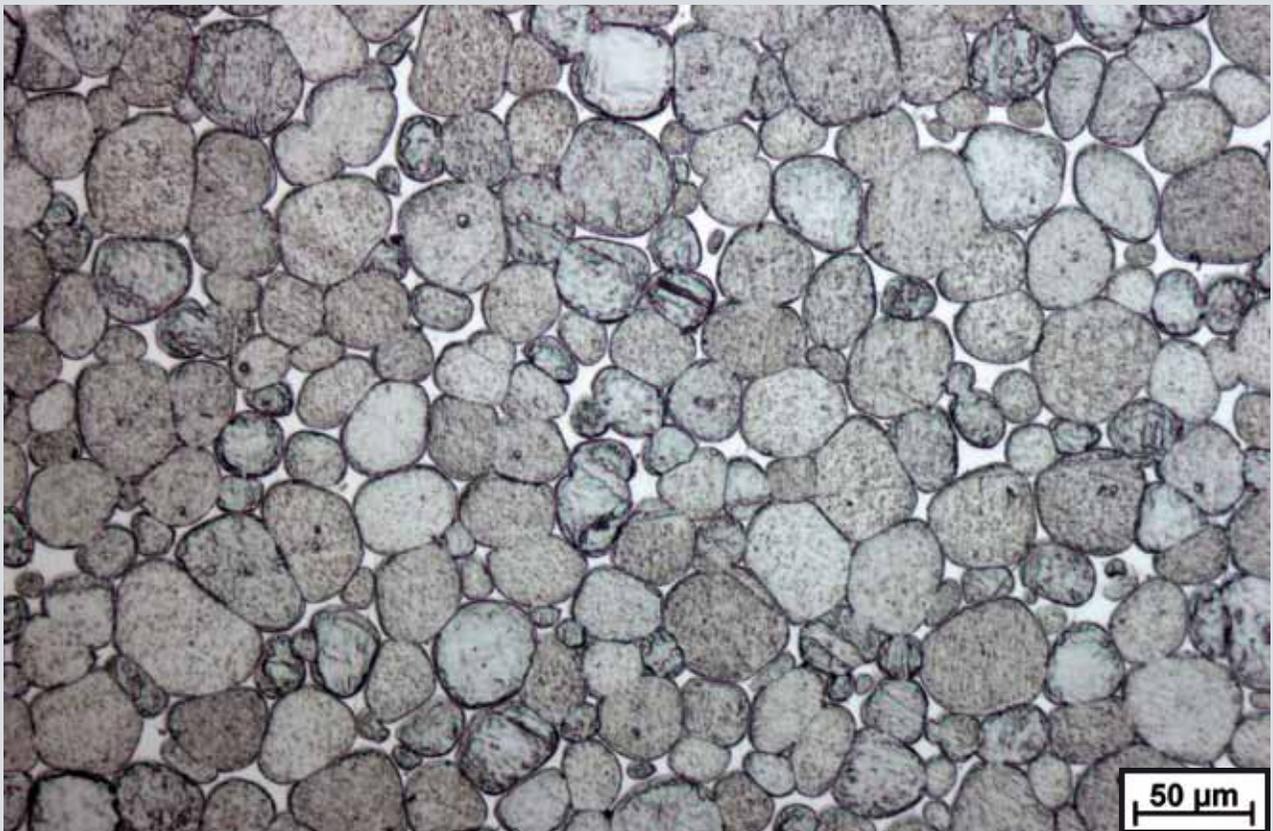
elongation at fracture during tensile load and the compressing ability under pressure. The firmness of this material increases slightly with the density up to a maximum.

Higher strength value is obtained by cold finishing, especially with TRIAMET® heavy metals of the „G“ family. This group has an iron-nickel binder and weak ferromagnetism, with a coercivity between 200 and 300 A/m.

If this residual magnetism is disturbing in the application of the heavy metal, TRIAMET® of the „S“ family can be used. Its binder of nickel and copper is paramagnetic and exhibits, along with the tungsten, a negligible coercivity of about 3 A/m.



TRIAMET® G17 B



TRIAMET® G18 B

TRIAMET® tungsten-based heavy metals – the quality you desire.

In the following tables, all the important qualities of the various TRIAMET® heavy metals are summarized. It should make it easier for a user to choose an appropriate heavy metal. Moreover, our technical advising service is available to you at any time for questions. Our TRIAMET® heavy metal also fulfills the requirements of ASTM B777.

Type	G14	S17	G17	G17B	G17M	S17,5	G17,5
Density [g/cm ³]	13,9 ± 0,2	17,0 ± 0,15	17,0 ± 0,15	17,0 ± 0,15	17,2 ± 0,15	17,5 ± 0,2	17,5 ± 0,2
Tungsten content [wt.%]	71	90	90	90	90	92,5	92,5
Bonding phases	Ni, Fe	Ni, Cu	Ni, Fe	Ni, Fe	Ni, Fe, Mo	Ni, Cu	Ni, Fe
Tensile strength [N/mm ²]	> 600	600 - 750	650 - 780	760 - 1000	700 - 950	600 - 800	650 - 850
Elongation A ₅ [%]	< 5	2 - 6	2 - 8	5 - 30	2 - 8	2 - 5	2 - 8
Module of elasticity [kN/mm ²]	-	310 - 330	320 - 340	320 - 340	350	330 - 350	340 - 360
Hardness [HV10]	> 230	270 - 320	270 - 320	270 - 320	280 - 330	280 - 330	280 - 330
Medium warmth expansion coefficient (20 - 800 °C) [10 ⁻⁶ /K]	-	6,0	6,45	6,45	5,4	5,7	5,7
Magnetic properties coercivity [A/m]	-	paramagnetic	weak ferromagnetic			paramagnetic	weak ferromagnetic
		3 - 4	250	250	400	3 - 4	230
Specific electric resistance [μΩ · cm]	-	13 - 14	15 - 18	15 - 18	15 - 18	12 - 13	13 - 16

Type	G17,5B	S18	G18	G18B	S18,5	G18,5	G19
Density [g/cm ³]	17,5 ± 0,2	18 ± 0,2	18 ± 0,2	18 ± 0,2	18,5 ± 0,2	18,5 ± 0,2	18,8 ± 0,2
Tungsten content [wt.%]	92,5	95	95	95	97	97	98,2
Bonding phases	Ni, Fe	Ni, Cu	Ni, Fe	Ni, Fe	Ni, Cu	Ni, Fe	Ni, Fe
Tensile strength [N/mm ²]	760 - 950	550 - 800	700 - 850	750 - 950	580 - 850	690 - 880	650 - 800
Elongation A ₅ [%]	5 - 25	1 - 5	2 - 6	3 - 25	< 3	< 3	< 2
Module of elasticity [kN/mm ²]	340 - 360	340 - 360	350 - 380	350 - 380	350 - 370	360 - 390	360 - 390
Hardness [HV10]	280 - 330	290 - 340	290 - 340	290 - 340	290 - 340	290 - 340	300 - 350
Medium warmth expansion coefficient (20 - 800 °C) [10 ⁻⁶ /K]	5,7	5,2	5,2	5,2	5,0	5,0	4,8
Magnetic properties coercivity [A/m]	weak ferromagnetic	paramagnetic	weak ferromagnetic		paramagnetic	weak ferromagnetic	
	230	3	220	250	2 - 3	210	200
Specific electric resistance [μΩ · cm]	13 - 16	11 - 12	13 - 15	15 - 18	9 - 10	10 - 11	9 - 11

TRIAMED® tungsten-based heavy metals – more diverse from experience.

For solving certain tasks in science and technology, the density of a material is of crucial importance. Non-ferrous metals up to and including lead still have a relatively minimal density.

Tungsten, gold, uranium and platinum exhibit the highest values. Due to their great value, gold and platinum are only seldom suitable to be used for their high density. The use of depleted uranium is not recommended, mostly due to safety reasons.

Pure tungsten, however, is difficult to work with. Only a chipless formation at temperatures over 1000 °C or a removal through grinding are economical. The shape cutting of tungsten with the usual procedures requires great experience and significant expense.

Under the brand name TRIAMED®, we manufacture a series of tungsten-based materials with additional binding agents of nickel-iron or nickel-copper alloys. Our decades of experience in the processing of tungsten and molybdenum has shown us to be specialists with innovative product ideas in this area of powder metallurgy.

TRIAMED® fulfills important functions in its various areas of application. Despite a high density of 17.0 -18.9 g/cm³, TRIAMED® materials are well-suited for machining using typical processing procedures, so that even complicated individual pieces can be fashioned from appropriate semi-finished material with the highest precision. On the other hand, they are very economical to produce as ore-finished series pieces due to their powder metallurgical manufacturing.

Next to extremely high-density values, TRIAMED® heavy metals also exhibit a high module of elasticity. The high module of elasticity and production typical of sintering material also contribute to a strong damping of vibrations in heavy metal bodies.

Another important property is the high absorption possibility for energy-rich electro magnetic radiation, which ensures extended use of TRIAMED® heavy metals in radiation protection. The good heat resistance in the area of 1000 °C and the low warmth coefficient of expansion lead to the use of special TRIAMED® qualities for tools in hot forming and in bonding technology.

Typical areas of application for TRIAMED®-heavy metal technology:



Vehicle construction



Aircraft construction



Medicine technology



Machine construction

Additional information and instructions for safe handling can be found on our homepage.

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