

Material Datasheet – Synaptite Grade 1

Last Update: 13.06.2024

Material description

Copper based metal matrix composite fabricated by Electro-Sinter-Forging for welding and brazing electrodes. This material shows a low conductivity/ high hardness ratio, without using Tungsten, Beryllium, Cobalt, Nickel and Chromium, while providing very little deformation at elevated and high temperatures.

The low conductivity requires material specific settings while allowing significant energy savings through shorter welding cycles.

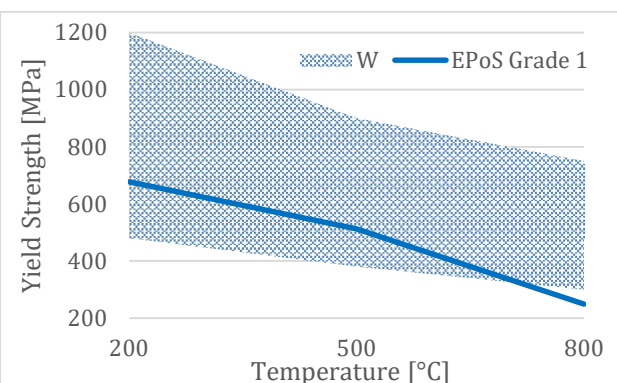
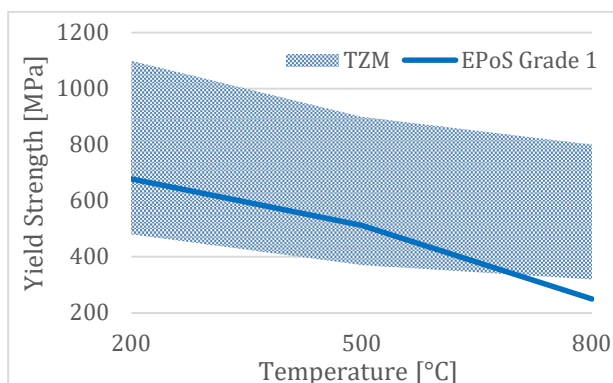
For use as a replacement for ISO 5182:2016 Group B Type 10-15 (RWMA Group B Class 10-14) W-Cu based materials.

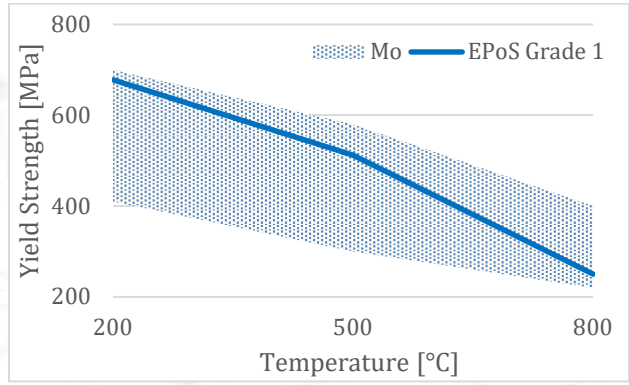
These materials can be machined with conventional carbide cutting tools and brazed with silver-based braze pastes.
 Synaptite Grade 1

Mechanical characteristics

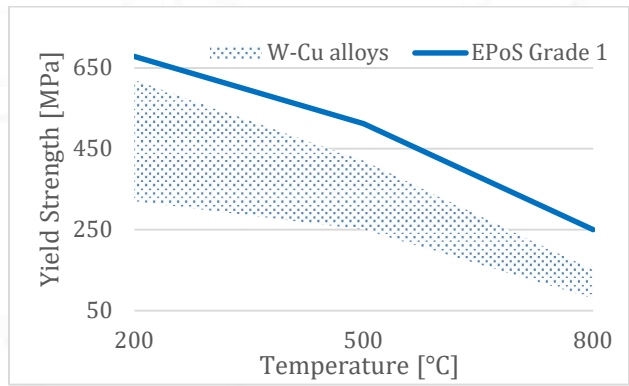
| | | Grade 1 | | |
|---|--|--------------|--------------|--------------|
| Mass density [g·cm⁻³] | | 8.225 | | |
| Hardness [HV₃₀] @RT | | 300-360 | | |
| <i>Properties at high temperature</i> | | <i>200°C</i> | <i>500°C</i> | <i>800°C</i> |
| Yield strength [MPa] | | 650 | 420 | 210 |
| Compressive strength [MPa] | | 680 | 510 | 260 |
| Compression at break [-] | | 0.06 | 0.09 | 0.25 |

Yield strength at high temperature



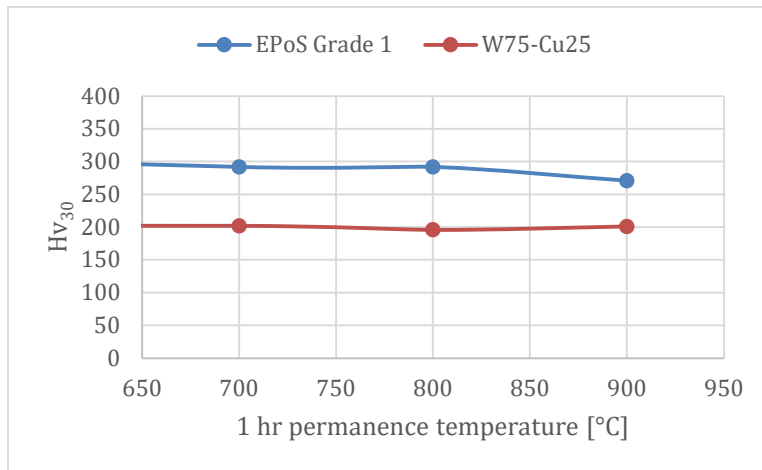


Yield strength of Grade 1 measured at different temperatures on a Gleeble 3800 and compared to TZM, W and Mo (upper boundary: stress relieved – lower boundary: recrystallized).



Yield strength of Grade 1 measured at different temperatures on a Gleeble 3800 and compared to W-Cu alloys (upper boundary: W-15Cu – lower boundary: W-25Cu).

Softening tests



Grade 1 exhibits superior hardness retention after permanence for one hour in ambient atmosphere, compared to commercial W75-Cu25.

Resistance welding and brazing application

| RWMA | ISO | Welding | Brazing |
|------|-----|---------|---------|
|------|-----|---------|---------|

| | | | | |
|----------------|------------------------|-----------------------|-----------------------------|--------------------------------------|
| Grade 1 | Group B Class 10-14 | Group B Type 10-15 | Yellow brass (Aluminum)* | Low melting brazes (e.g. SnAg) |
|----------------|------------------------|-----------------------|-----------------------------|--------------------------------------|

The material is particularly suitable for spot welding brass as alternative to WCu-alloys and for brazing copper wires as alternative to W and WCu-alloys. It can be used for spot welding, roller seam welding, projection welding and upset welding for long service life, uniform welding parameters and shortened weld times.

Mechanical properties

Deformation during welding has been evaluated using an internal protocol (Pressure of 300 MPa, 4 pulses at a frequency of one every 8 seconds and a with a peak current of 70-90 kA) with capacitor discharge welding equipment:

| | RWMA | ISO | Deformation[%] |
|----------------|------------------------|-----------------------|----------------|
| Grade 1 | Group B Class 10-14 | Group B Type 10-15 | 1.8% |
| W75Cu | Group B Class 11 | Group B Type 10 | 2.1% |
| W | Group B Class 13 | Group B Type 14 | 0.5% |
| Mo | Group B Class 14 | Group B Type 13 | 2.5% |

Forms available

Disks up to 25 mm
 Square or rectangular plates with area up to 480 mm²
 Parts are produced according to desired height, from 2 to 15mm.
 Semi-finished machined products and specific sizes available on request

Health and Safety

No substances classified under the Annex XVII to REACH are used in this group of materials. Cobalt, Chromium, Nickel, and Beryllium free.

Industry Standards and Specifications

EPoS proprietary eForging technology creates novel welding materials from metal powders.

There are no official standards or specifications for ISO or RWMA eForged materials, other than meeting the minimum hardness and conductivity as listed in RWMA Bulletin 16.

Typically, pressure infiltrated materials are manufactured by sintering an open pore structure of e.g. W and WC in long lasting high temperature cycles under protective atmospheres and subsequent pressure infiltration of Cu, leading to a continuous path of Cu in the microstructure.

EPoS eForging-technology shortens the consolidation cycle to less than one second and retains the very fine microstructure from the original powder composition. In that system the amounts of grain

boundaries and grains that the currents must travel through is multiple times higher, leading to increase in resistance while strengthening the materials hardness at elevated/high temperatures.

Soldering

Solders used for RWMA Group A is recommended.

Short circuit calibration

EPoS Grade 1 recommended parameters:

- current of 7kA
- duration 100ms
- force 4kN