



AMPCO *Sintered Alloys*

Products for: - Resistance Welding Electrodes
- Electrical Contact Materials

Product Definition & Uses

The high electrical and thermal conductivity of copper is combined with arc-resistant and non-welding properties of tungsten and molybdenum, or their carbides, to form extensive series of compositions, each designed to give the best performance for your particular application.

These materials are generally used as electrode materials for resistance welding and similar related applications and for such heavy duty contact applications, relays, switches, etc...

These materials excel in these applications because they will withstand the effects of the arcing to the interruption of large currents.

Typical applications include :

- resistance welding electrodes
- EDM electrodes
- circuit breakers (air and/or oil immersed)
- arcing tips
- make-and-break contacts
- heavy-duty contactors
- relays/switches

Superior Performance

Ampco refractory alloys are manufactured by the powder metallurgy techniques of pressing, sintering and infiltrating in a very high degree of uniformity, held in the fine-grained microstructure of the finished material. To the user this means an extremely high performance material which will stand up uniformly to the most severe applications and outlast other brands.

Ampco copper-tungsten alloys are of the highest quality available and the physical properties of our alloys are considerably above those specified under RWMA standards.

| RWMA Class | AMPCO Grade | Alloy Type |
|-----------------|-----------------|-----------------|
| Class 10 | A1WC | Copper-Tungsten |
| Class 11 | A10WC | Copper-Tungsten |
| Class 12 | A20/30WC | Copper-Tungsten |
| Class 13 | A100W | Pure Tungsten |
| Class 14 | A100M | Pure Molybdenum |

Material Properties

| A1W | A10W | A20W | A30W | A100W |
|-----------------|-----------------|-----------------|-----------------|-------------|
| 56% W 44% Cu | 75% W 25% Cu | 78% W 22% Cu | 80% W 20% Cu | 100% W |
| 55-60% IACS | 42-50% IACS | 42-50% IACS | 45% IACS | 31% IACS |
| 72-82 HRB | 96-99 HRB | 97-101 HRB | 99-104 HRB | 69 HRA |
| Class 10 | Class 11 | Class 12 | Class 12 | Class 13 |
| | | | | |

Other items are available and will be quoted on request:

- Silver-tungsten
- Pure molybdenum
- Wire
- Tubing
- Sheet stock
- Special shapes and forms

For further information, please contact:

AMPCO METAL INCORPORATED

1117 EAST ALGONQUIN ROAD

ARLINGTON HEIGHTS

ILLINOIS 60005

Tel: 001 8474376000

Fax: 001 8474376008

E-Mail: info@ampcometal.com

www.ampcometal.com



About Sintered Products

Copper-Tungsten

Refractory bi-metal composite produced by a tightly controlled process of pressing and sintering tungsten powder and then infiltrating the sintered material with copper.

Copper Tungsten Grades

| Grade | Description | % | RWMA Class | Density Grams/cm ³ | Elect. Cond. %IACS | Hardness |
|-------|----------------------------|------------|------------|-------------------------------|--------------------|-----------------------|
| A1WC | Tungsten Copper | 56% 44% | 10 | 12.60 | 50-60 | 72-82 _{RB} |
| A3WC | Tungsten Copper | 68% 32% | 10 | 13.93 | 48-53 | 85-92 _{RB} |
| A5WC | Tungsten Copper | 70% 30% | 10 | 14.18 | 47-52 | 88-95 _{RB} |
| A10WC | Tungsten Copper | 75% 25% | 11 | 14.80 | 42-50 | 96-99 _{RB} |
| A30WC | Tungsten Copper | 80% 20% | 12 | 15.60 | 41-49 | 99-104 _{RB} |
| A10WA | Alloy * Tungsten Copper | 75% 25% | * | 14.80 | 25-30 | 104-110 _{RB} |

Note: The values are typical and not to be used for specifications.

* Heat treatable copper alloy. These grades furnished fully heat treated.

Silver-Tungsten

Refractory bi-metal composite produced by a tightly controlled process of pressing and sintering tungsten powder and infiltrating the sintered material with silver.

Silver Tungsten Grades

| Grade | Description | % | RWMA Class | Density Grams/cm ³ | Elect. Cond. %IACS | Hardness |
|-------|--------------------|------------|------------|-------------------------------|--------------------|----------------------|
| A50WS | Tungsten Silver | 50% 50% | - | 13.48 | 62-70 | 50-60 _{RB} |
| A35WS | Tungsten Silver | 65% 35% | - | 14.77 | 50-56 | 80-87 _{RB} |
| A20WS | Tungsten Silver | 78% 22% | EDM ECM | 15.56 | 48-53 | 90-100 _{RB} |

Note: The values are typical and not to be used for specifications.



Molybdenum-Tungsten

Pure Molybdenum and Tungsten refractory metals stocked in both rod and plate form for expedited delivery.

Molybdenum and Tungsten Grades

| Grade | Description | % | RWMA Class | Density Grams/cm ³ | Elec. Cond. %IACS | Hardness |
|-------|-------------|-----|------------|-------------------------------|-------------------|-------------------|
| A100W | Tungsten | 100 | 13 | 1928 | 31 | 69 R _A |
| A100M | Molybdenum | 100 | 14 | 10.20 | 30 | 89 R _A |

Note: The values are typical and not to be used for specifications.

About Applications

RESISTANCE WELDING

A group of welding processes where joining of metal is accomplished by the heat produced from the resistance of the article to flow of electrical current in a circuit of which the article is a part. This occurs when pressure is directed at the electrodes where the electrical circuit is initiated and concluded.

Resistance Welding Electrode Material

Copper-tungsten and silver-tungsten are manufactured for specific use as electrode materials for resistance welding and other similar related electrical contact wear applications.

Refractory alloys are manufactured by the powder metallurgy techniques of pressing, sintering and infiltrating of tungsten with copper or silver. Those alloys are produced under rigid manufacturing fixed processes resulting in a high degree of metallurgical uniformity held in the fine-grained micro-structure of the finished materials. To the user this means an extremely high performance welding electrode which will perform well under most severe applications.

Resistance Welding Electrode Materials

| Grade | Description | % | RWMA Class | Density Grams/CC | Elec. Cond. % IACS | Hardness | General Use |
|-------|--------------------|------------|------------|------------------|--------------------|----------|---|
| A1WC | Tungsten Copper | 56% 44% | 10 | 12.60 | 55-60 | 72.-82 | Flash and butt welding die inserts. Spot welding ferrous metals, stainless steel where the electrode should have higher thermal and electrical conductivity than Class 11 material. |
| A3WC | Tungsten Copper | 68% 32% | 10 | 13.93 | 48-53 | 85-92 | |
| A5WC | Tungsten Copper | 70% 30% | 10 | 14.18 | 47-52 | 88-95 | Light duty projection welding dies where welding pressures are not extreme |
| A10WC | Tungsten Copper | 75% 25% | 11 | 14.80 | 42.-50 | 94-99 | Standard for electrode and die inserts on most flash and buff welding dies. For projection welding dies where welding pressures are moderate, also used for light electrical upsetting, electro forming dies, and seam welder |



| | | | | | | | |
|--------------|-------------------------------|------------|----|-------|-------|---------|---|
| | | | | | | | bushing inserts |
| A30WC | Tungsten Copper | 80% 20% | 12 | 15.60 | 41-59 | 99-104 | For volume production, welding dies where pressures are relatively high, electrical upsetting of nonferrous metals and low carbon steel when used as die facings. Cross wire welding of wire and rod. |
| A10WA | Tungsten Copper Alloy * | 75% 25% | * | 14.80 | 25-30 | 104-110 | Supplied in the fully heat treated condition. Used for electroforming and electrical upsetting where temperatures and pressures are high. |
| A50WS | Tungsten Silver | 50% 50% | - | 13.48 | 62-70 | 50-60 | For special welding applications where a corrosion resistant electrode is needed. |
| A35WS | Tungsten Silver | 65% 35% | - | 14.77 | 50-56 | 80-87 | |
| A100W | Tungsten | 100% | 13 | 19.28 | 31 | 69 | Pure Tungsten is very hard with low ductility. Principally used to weld nonferrous materials since it will not alloy with them. |
| A100M | Molybdenum | 100% | 14 | 10.20 | 30 | 89 | Molybdenum is not as hard as tungsten, and can be machined. It has the same application as tungsten. |

*Heat treatable copper alloy. These grades furnished fully heat treated.

NOTE: The values are typical and not to be used for specifications.

EDM-ing and ECM-ing

Copper-tungsten and silver tungsten can also be used as materials for EDM (Electrical Discharge Machining) and ECM (Electro Chemical Machining).

Such materials are also manufactured by the powder metallurgy techniques of pressing, sintering and infiltrating tungsten with copper or silver. EDM-, ECM products are produced under the same rigid manufacturing, fixed processes and strict quality control supervision. This assures a high performance electrode providing greater cutting stability, excellent machinability and reduced down time. For extremely close tolerance work, these materials maintain dimensional accuracy and will have longer operating life due to the high metallurgical integrity found in our copper or silver-tungsten electrode materials.

EDMing/ECMing Materials

| Grade | Description | % | RWMA Class | Density Grams/cm ³ | Elect Cond % IACS | Hardness |
|--------------|--------------------|------------|------------|-------------------------------|-------------------|-----------------------|
| A15WC | Tungsten Copper | 70% 30% | EDM ECM | 14.25 | 44-52 | 90-96 R _B |
| A10WC | Tungsten Copper | 75% 25% | 11 | 14.80 | 42-50 | 96-99 R _B |
| A30WC | Tungsten Copper | 80% 20% | 12 | 15.60 | 41-49 | 99-104 R _B |



| | | | | | | |
|--------------|--------------------|------------|------------|-------|-------|-----------------------|
| A20WS | Tungsten Silver | 78% 22% | EDM ECM | 15.56 | 48-53 | 90-100 R _B |
|--------------|--------------------|------------|------------|-------|-------|-----------------------|

NOTE: The values are typical and not to be used for specifications.

Electrical Contact Material

Neither copper nor silver will alloy appreciably with molybdenum or tungsten, but through a tightly controlled powder metallurgy process, one can produce a homogeneous bi-metal for electrical contact use. These bi-metals afford the user superior chemical, mechanical and electrical properties.

In addition, the high electrical and thermal conductivity of the silver or copper along with the arc-resistant and non-welding properties of molybdenum or tungsten, provide the customer with a wide range of bi-metals to best suit their needs.

Because these bi-metals withstand the effects of the arcing incident to the interruption of large current they are often used for circuit breakers, relays, switches and heavy duty contractors.

Electric Contact Materials

| Grade | Description | % | RWMA Class | Density Grams/cm ³ | Elect Cond % IACS | Hardness |
|--------------|--------------------|------------|------------|-------------------------------|-------------------|-----------------------|
| A3WC | Tungsten Copper | 68% 32% | 10 | 13.93 | 48-53 | 85-92 R _B |
| A5WC | Tungsten Copper | 70% 30% | 10 | 14.18 | 47-52 | 88-95 R _B |
| A10WC | Tungsten Copper | 75% 25% | 11 | 14.80 | 42-50 | 96-99 R _B |
| A30WC | Tungsten Copper | 80% 20% | 12 | 15.60 | 41-49 | 99-99 R _B |
| A50WS | Tungsten Silver | 50% 50% | - | 13.48 | 62-70 | 50-60 R _B |
| A35WS | Tungsten Silver | 65% 35% | - | 14.77 | 50-56 | 80-87 R _B |
| A20WS | Tungsten Silver | 78% 22% | EDM ECM | 15.56 | 48-53 | 90-100 R _B |

NOTE: The values are typical and not to be used for specifications