

THE PROCESS OF PRODUCING TUNGSTEN ALLOYS

efi ED FAGAN INC.
Special Purpose Alloys
THE MATERIALS YOU NEED, WHEN YOU NEED THEM

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METALLURGY



The process of producing Tungsten alloys is termed — **LIQUID PHASE SINTERING**. At the final sintering temperature, the Nickel/Iron or Nickel/Copper powders melt, causing the Tungsten particles to dissolve into solution. Upon cooling, the excess Tungsten nucleates as spherical particles (grey spheres) surrounded by Tungsten — Nickel — Iron alloy (white areas).

POWDER PREPARATION

Tungsten, Nickel, Iron (or Copper) are mixed as powders in various mills, depending on end use.

For use in automatic presses, powders have to be screened and mixed to be granular. This enables the product to flow smoothly into the mold. Powders used in large presses can be “fluffy” as they can be hand-fed with “shovel type” implements to fill the large mold.

PRESSES

MANUAL



Hand-fed presses are used to produce larger parts.

Press tonnage runs from 100-1,000 tons (and higher).

Operator run presses can produce an average of 1-20 pieces per hour.

AUTOMATIC



Dedicated to small and medium sized parts where powder is fed automatically into the mold.

Automatic presses can produce from 20—2,000 pieces per hour.

HYDROSTATIC



Designed to press parts with long length to diameter ratios; i.e., 18” L x 1” Dia.

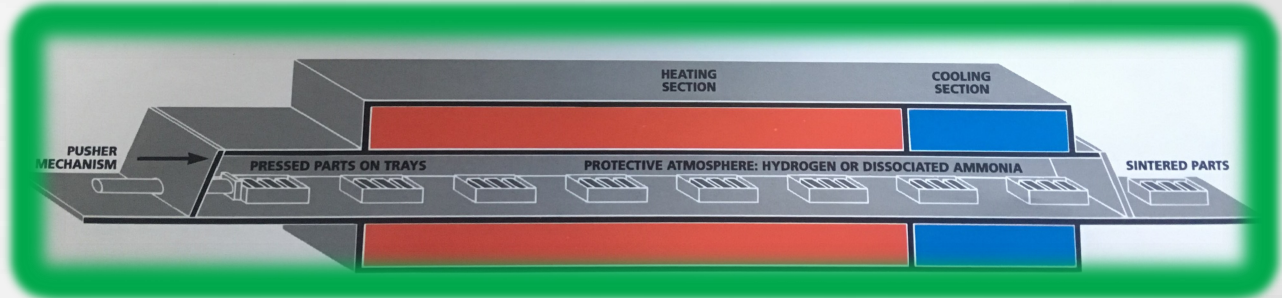
Tungsten alloy powder is poured into a rubber mold and capped. The mold is placed into the hydrostatic press. The mold is then surrounded by a mixture of water and glycerin.

Pressure is applied up to 30,000 lb./sq. inch. The pressed part “green” is removed from the rubber mold and then enters the sintering process.

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FURNACES

Furnaces are termed “Pusher or Stoker Furnaces”. Parts are placed in Molybdenum “boats” — 8” wide x 18 - 24” long and a stoker continually pushes, at a defined rate of one boat per hour, yielding 24 boats per day. Typical load per boat is 8 to 10 kg.



The furnace atmosphere is pure hydrogen or a combination of hydrogen-nitrogen atmosphere. The operator removes a boat from the exit or cool end of the furnace and then pulls the stoker back to place a new boat at the entry end.

Sintered blanks are normally produced to a “Rough Oversize To Finish” (ROTF) size. Extra stock is added to each dimension to permit finishing to final dimension.

Sintering consists of the following operations:

1.

DEBONDING (900°C)

Pressed parts have wax (paraffin) added to hold part together. Debonding removes the wax or the part will not sinter properly.

2.

PRESINTER (1100°C)

This sintering operation is generally employed for parts that are designed to sinter to size. It allows the parts to shrink slowly to prevent distortion.

3.

FINAL SINTER (1380°-1420°C)

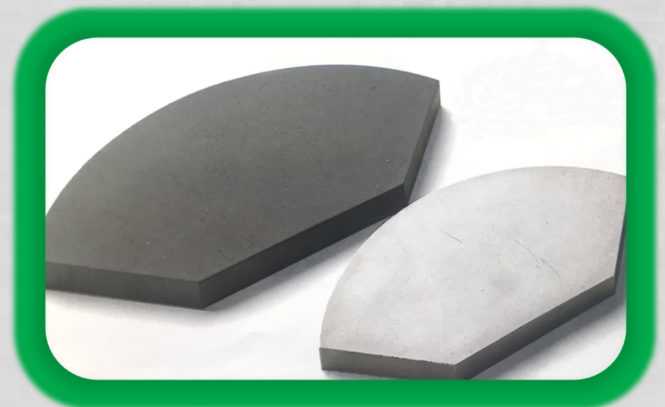
This sintering operation results in parts arriving at final designed size. Shrinkage is not always even and this is why control of final dimensions is difficult and extra stock (ROTF) is added.

SPECIAL SINTERING

For very large parts, there are furnaces that can do all above operations in one cycle; 18 -24 hours.

END PRODUCT

The sintering process results in the pressed part to shrink (15%-18%) — depending on amount of pressure initially exerted on the pressed piece. A pressed part with a height of 1.0” finally sinters to 0.82 to 0.85” height.



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