



# Others are hot on that.

## Heating elements made from tungsten and molybdenum.

We develop and produce technically intelligent solutions from tungsten and molybdenum for the construction of high-temperature kilns.

Completely according to your requirements we optimize heating elements with alloys and the addition of rare earths.

Characteristics of all Wolfram Industrie elements for high-temperature kilns are:

- 1 highest purity
- 2 best dimensional stability
- 3 outstanding creep resistance
- 4 excellent corrosion resistance
- 5 maximum operating temperatures of up to 2,800 °C

# Cool up to 2,800°C – elements from Wolfram Industrie® for high-temperature kilns

Heating elements made from tungsten and molybdenum are perfectly suitable for the construction of high-temperature kilns due to their maximum operating temperatures, their long service life and their definable behavior towards gases and furnace materials.

## Versions and alloys

Despite high manufacturing costs, tungsten and molybdenum are often used in the construction of furnaces (heating materials, heating ropes, combustion boats etc.) thanks to the considerable maximum operating temperatures (1,500°C to 2,800°C) and the long service life. The surface load of wires can be up to 20 W cm<sup>-2</sup>. Wolfram Industrie offers several alloys for furnace construction.

Material	Composition	Recrystallization temperature* start/end at an annealing period of 1 h	Max. operating temperature
WP	Tungsten pure (W: > 99.97%)	1,150°C/1,350°C	2,800°C
WG	Tungsten doped W: 99.95% K: 15 – 90 ppm	1,500°C/1,750°C	2,800°C
WS2®	W: > 98% rare earth oxide: < 2.0%	1,450°C/1,650°C	2,800°C
Inostar®	W: > 97.5% rare earth oxide: < 2.5%	1,500°C/1,750°C	2,800°C
Mo	Molybdenum pure (Mo: > 99.97%)	900°C/1,200°C	1,800°C
MoG	Mo: > 99.0% K+Si+Al: < 1000 ppm	1,400°C/1,650°C	1,900°C
MoY	Mo: > 99.3% rare earth oxide: 0.7%	1,450°C/1,700°C	1,900°C
MoLa	Mo: > 99.2 – 99.97% rare earth oxide: < 0.03 – 0.8%	1,450°C/1,700°C	1,900°C
TZM	Ti: 0.5% Zr: 0.08% C: 0.01 – 0.04% Mo: Balance		1,800°C

\*depending on rod or wire diameter

When using tungsten and / or molybdenum as materials in furnace construction, as well as their physical and mechanical properties, their behavior towards the furnace atmosphere and the furnace materials must also be considered.

## Behavior towards gases

Atmosphere	Behavior	
	Molybdenum	Tungsten
Inert gases	no reaction up to highest temperatures	no reaction up to highest temperatures
Air and oxygen	above 300°C oxidation above 600°C sublimation	above 300°C oxidation above 700°C sublimation
Nitrogen	no reaction up to highest temperatures	no reaction up to 2,300°C
Hydrogen (dry)	no reaction up to highest temperatures	no reaction up to highest temperatures
Hydrogen (wet)	no reaction up to 1,400°C	no reaction up to 1,400°C

## Behavior towards furnace materials

Material	Behavior (in a vacuum)	Behavior (inert gas)
Aluminium oxide	no reaction up to 1,900°C	no reaction up to 1,700°C
Beryllium oxide	no reaction up to 1,900°C	no reaction up to 1,700°C
Graphite	above 1,100°C carbide formation	above 1,100°C carbide formation
Magnesite brick	no reaction up to 1,600°C	no reaction up to 1,450°C
Magnesium oxide	no reaction up to 1,600°C	no reaction up to 1,450°C
Silicon carbide	above 1,300°C carbide formation/silicidation	above 1,300°C carbide formation/silicidation
Zirconium oxide	no reaction up to 1,900°C	no reaction up to 1,700°C

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

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