

# Kovar (shown in Blue)

## LOW THERMAL-EXPANSION, SUPER ALLOY HRA929 FOR GAS TURBINES

### Overview

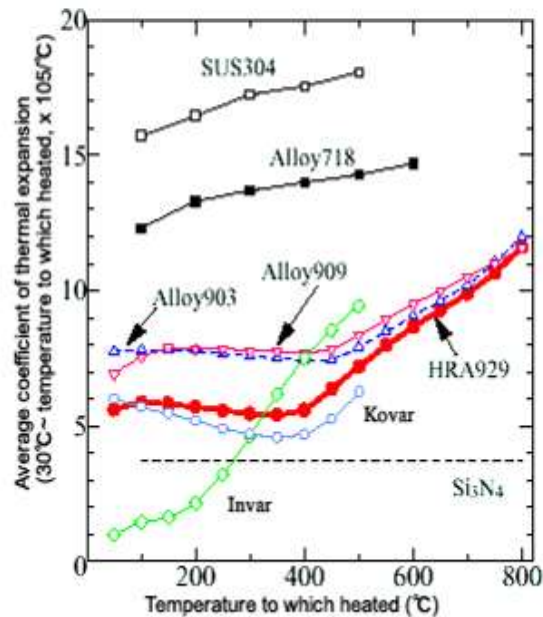
Kovar alloys composed of Fe-36Ni invar alloy and Fe-29Ni-17Co are known for their generally low coefficients of thermal expansion. But, because they are not particularly strong, these alloys are not suitable for parts that are used in high-stress environments or exposed to high temperatures.

However, HRA929, which Hitachi Metals developed using alloy design techniques, has not only a low coefficient of thermal expansion but also [illegible] precipitation strength, enabling it to retain its strength in temperatures of up to approximately 650°C. Furthermore, this alloy displays superior structural stability and ductility.

### Features

(1) Low coefficient of thermal expansion, close to that of Kovar.

Figure 1: Average coefficient of thermal expansion of various alloys



# Properties of Copper

## Mechanical Properties

**Table 2.** Typical mechanical properties for copper alloy C101

Grade	C101
Tensile Strength (MPa)	200-360
Proof Stress 0.2% (MPa)	50-340
Elongation A5 (%)	42
Hardness VPN	40

## Physical Properties

**Table 3.** Typical physical properties for copper alloy C101

Property	Value
Density	8.91 g/cm <sup>3</sup>
Melting Point	1083 °C
Modulus of Elasticity	117 GPa
Electrical Resistivity	0.0171x10 <sup>-6</sup> Ω.m
Thermal Conductivity	391.1 W/m.K at 100°C
Thermal Expansion	16.9x10 <sup>-6</sup> /K at 100°C