

铁镍钴玻封合金 4J29 和 4J44 (YB/T5231-1993)

Fe-Ni-Co glass seal alloys 4J29 and 4J44 (YB/T5231-1993)

(1) 牌号和化学成分见表 1

Alloy grade and chemical composition are shown in Table 1

表 1 合金的牌号和化学成分

Table 1 Material designation and chemical composition of the alloy

牌号 Alloy grade	C	P	S	Mn	Si	Cu	Cr	Mo	Ni	Co	Fe
4J29	0.03	0.020	0.020	0.5	0.30	0.20	0.20	0.20	28.5~29.5	16.8~17.8	余量 REM
4J44	0.03	0.020	0.020	0.5	0.30	0.20	0.20	0.20	34.2~35.2	8.50~9.50	余量 REM

注：1. Al、Mg、Zr 和 Ti 的含量各不大于 0.10%，其总含量应不大于 0.20%，若需方有特殊要求时，应在合同中注明。

Remark: 1. The content of Al, Mg, Zr and Ti shall not be more than 0.10% each, and the total content shall not be more than 0.20%. If the customer has special requirements, it shall be indicated in the contract.

2. 在平均线胀系数满足本标准规定条件下，允许镍、钴含量偏离表中规定范围。

Under the condition that the average linear expansion coefficient meets the requirements of this standard, the content of nickel and cobalt is allowed to deviate from the specified range in the table.

3. 合金材的尺寸和外形应符合 GB/T14985《膨胀合金》的有关规定。

The size and shape of the alloy shall comply with the relevant provisions of GB/T14985 "Expansion Alloy".

(2) 力学性能见表 2-表 4。

The mechanical properties are shown in Table 2- Table 4.

表 2 丝材的抗拉强度

Table 2 Tensile strength of wire

状态代号 Status code	状态 Status	抗拉强度/MPa Tensile strength/MPa
R	软态 Soft	<585
1/4 1	1/4 硬态 1/4 Hard	585~725
1/2 1	1/2 硬态 1/2 Hard	655~795
3/4 1	3/4 硬态 3/4 Hard	725~860
1	硬态 Hard	>860

表 3 带材的抗拉强度
Table 3 Tensile strength of strip

状态代号 Status code	状 态 Status	抗拉强度/MPa Tensile strength/MPa
R	软态 Soft	<570
1/4 1	1/4 硬态 1/4 Hard	520~630
1/2 1	1/2 硬态 1/2 Hard	590~700
3/4 1	3/4 硬态 3/4 Hard	600~770
I	硬态 Hard	>700

表 8-4 深冲态带材的硬度
Table 8-4 Hardness of strip in deep drawing state

状态 Status	厚度/mm Thickness/mm	硬度 Hv Hardness Hv
深冲态 Deep drawing state	>2.5	<170
	<2.5	<165

(3) 物理性能见表 5、表 6。

Physical properties are shown in Table 5 and Table 6.

表 5 合金的线胀系数

Table 5 Linear expansion coefficient of the alloy

牌号 Alloy Grade	试样热处理制度 Sample heat treatment system	平均线胀系数 $\alpha/(10^{-6}/K)$ Average coefficient of linear		
		20~300C	20~400C	20~450°C
4J29	在氢气气氛中加热至 900±20°C，保温 1h,再加热至 1100±20°C，保温 15min,以不大于 5°C/min 速度冷却至 200C 以下出炉 Heat in a hydrogen atmosphere to 900±20°C and hold for 1 hour, then heat to 1100±20°C and hold for 15 minutes. Cool down to below 200°C at a rate of no more than 5°C/min and remove from furnace.		4.6—5.2	5.1 — 5.5 ①
4J44		4.3—5.1	4.6—5.2	

用于晶体管时上限为 5.6。

The upper limit is 5.6 when used for transistors.

表 6 合金的典型膨胀系数

Table 6: Typical Coefficients of Thermal Expansion for Alloys.

合金 牌号 Alloy Grade	平均线胀系数 $\alpha/(10^{-6}/K)$ Mean linear coefficient of thermal expansion							
	20—200C	20—300C	20—400C	20—450C	20—500C	20—600C	20—700C	20—800C
4J29	5.9	5.3	5.1	5.3	6.2	7.8	9.2	10.2
4J44	4.9	4.6	4.9	5.9	6.8	8.7		

注：表中所列数据仅供参考。用途适用于与硬玻璃匹配封接。

Note: The data listed in the table is for reference only. The application is suitable for sealing with hard glass.