

High-Strength Fabricated Refractory Anchors Tech Brief

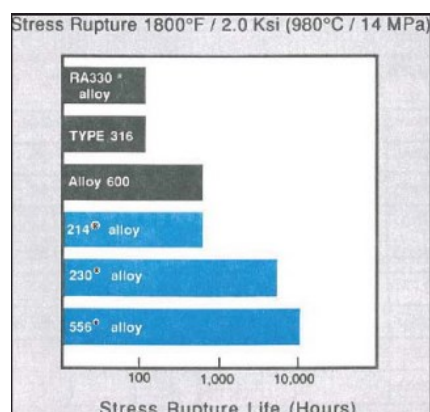
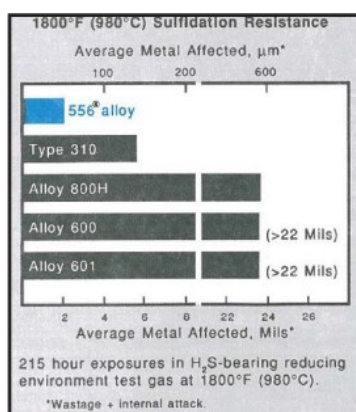
For High-Strength Refractory Anchors and Insulation Studs

When the refractory lining and insulation in your furnace or high-temperature process vessel fails, you're in for some costly unscheduled downtime and repairs. Those less-expensive cast anchors and fabricated studs mean frequent preventive maintenance at best, and at worst could mean your operations go down when you can't afford to go down.

Cast or wrought refractory anchors and insulation studs made from HAYNES® 214®, 230®, and 556® alloys can keep your refractory and insulation in service where it belongs. 214® alloy has the best resistance to oxidation, and can be used at temperatures as high as 2300°F (1260°C). 230® alloy provides the best combination of elevated temperature strength, oxidation-resistance, resistance to nitriding and resistance to carbo-nitriding. It can be used in demanding applications at temperatures up to at least 2100°F (1150°C)

For sulfur-bearing, carburizing, or other high-temperature aggressive environments, the best choice may be 556® alloy. Combining exceptional strength with its environment resistance, 556® alloy provides excellent service up to 2000°F (1095°C).

Resistance to Combustion Gas Environment 2000°F (1095°C) for 500 Hours				
Alloy	Metal Loss		Max. Metal Affected	
	mils	µm	mils	µm
-				
214®	0.5	13	1.8	46
230®	2.2	56	5.7	145
RA330®	10.9	277	13.6	345
600	17.2	437	20.7	526
Type 310	21.2	538	24.1	612
601	10.7	272	>24.0	>610



Nominal Composition

230®		214®		556®	
Nickel:	Balance	Nickel:	Balance	Nickel:	20
Iron:	3 max.	Iron:	3	Iron:	Balance
Cobalt:	5 max.	Cobalt:	2 max.	Cobalt:	18
Chromium:	22	Chromium:	16	Chromium:	22
Molybdenum:	2	Molybdenum:	-	Molybdenum:	3

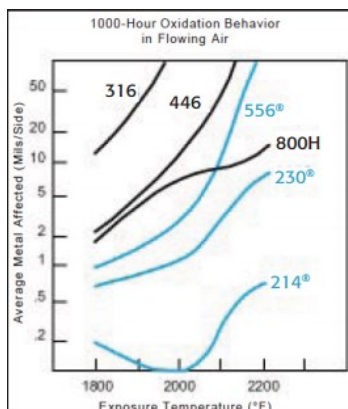
Tungsten:	14	Tungsten:	-	Tungsten:	2.5
Silicon:	0.4	Silicon:	0.2 max.	Silicon:	0.4
Manganese:	0.5	Manganese:	0.5 max.	Manganese:	1
Aluminum:	0.3	Aluminum:	4.5	Aluminum:	0.2
Carbon:	0.10	Carbon:	0.04	Carbon:	0.10
Boron:	0.015	Yttrium:	0.01	Nitrogen:	0.2
Lanthanum:	0.01	Zirconium:	0.1 max.	Tantalum:	0.6
				Lanthanum:	0.02
				Zirconium:	0.01

Product Description

HAYNES® 230® alloy combines excellent high-temperature strength, outstanding resistance to oxidizing environments up to 2100°F (1150°C) for prolonged exposures, premier resistance to nitriding environments, and excellent long-term thermal stability. It is readily fabricated and formed. Other attractive features include lower thermal expansion characteristics than most high-temperature alloys, and a pronounced resistance to grain coarsening with prolonged exposure to high-temperatures.

HAYNES® 556® alloy combines effective resistance to sulfidizing, carburizing and chlorine-bearing environments at high temperatures with good oxidation resistance, fabricability, and excellent high-temperature strength. It has also been found to resist corrosion by molten chloride salts, molten zinc, and other aggressive environments.

HAYNES® 214® alloy is the most oxidation-resistant, carburization-resistant, and chlorination-resistant alloy available as a fabricable material. Its effective use temperature limit is in excess of 2200°F (1204°C) for prolonged exposure, and up to 2400°F (1316°C) for shorter exposures.



Typical Tensile Properties

Test Temperature		0.2% Yield Strength				Ultimate Tensile Strength				Elongation						
°F	°C	MPa		ksi		MPa		ksi		%						
-	-	230®		556®		214®		230®		556®		214®				
70	20	12	393	61	421	84	579	12	862	19	820	57	972	48	48	38
1200	650	97	269	34	234	85	586	97	669	87	600	30	269	55	52	31
1400	760	85	283	33	228	80	552	85	586	70	483	41	283	46	50	17
1600	870	58	221	29	200	45	310	58	400	47	324	32	221	59	53	30
1800	980	33	117	16	110	8	55	33	228	28	193	17	117	71	64	72

2000	1095	17	55	8	55	3	21	17	117	15	103	8	55	50	59	99
2100	1150	11	39	-	-	2	14	11	79	-	-	6	39	40	-	99
2200	1205	8	26	-	-	1	10	8	55	-	-	4	26	31	-	99

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