

HAYNES[®] HR-224[®] alloy

Oxidation Resistance

Comparative Oxidation Resistance in Flowing Air

Material	1600°F (871°C)				1800°F (982°C)			
	Average Metal Loss		Average Metal Affected		Average Metal Loss		Average Metal Affected	
	Mils	µm	Mils	µm	Mils	µm	Mils	µm
HR-224[®]	0	0	0.2	5	0	0	0.3	8
214[®]	0	0	0.3	8	0	0	0.5	13
230[®]	0	0	0.9	23	0.2	5	1.6	41
625	0.1	3	0.6	15	0.2	5	1.9	48
X	0.1	3	1	25	0.3	8	1.9	48
HR-120[®]	0.1	3	1.1	28	0.3	8	2.0	51
601	-	-	-	-	0.4	10	1.7	43
800HT	0.1	3	1	25	0.5	13	4.1	104
347 SS	0.3	8	0.7	18	-	-	-	-
253 MA	0.2	5	0.9	23	1.3	33	3.0	76

Flowing air at a velocity of 7.0 ft/min (213.4 cm/min) past the samples. Samples cycled to room temperature once per week.

Comparative Long-Term Oxidation Resistance

Material	1800°F (982°C)			
	Average Metal Loss		Average Metal Affected	
	Mils	µm	Mils	µm
HR-224[®]	0.1	3	0.1	3
214[®]	0.1	3	0.5	13
230[®]	0.1	3	2.7	69
X	0.2	5	2.8	71
HR-120[®]	0.5	13	3.3	84
625	2.6	66	8.6	218

Alloys exposed for 360 days (8,640 h) in flowing air, cycled once per month.

Comparative Oxidation Resistance in Water Vapor

Material	1400°F (760°C)				1600°F (871°C)			
	Average Metal Loss		Average Metal Affected		Average Metal Loss		Average Metal Affected	
	Mils	µm	Mils	µm	Mils	µm	Mils	µm
HR-224[®]	0.05	1	0.25	7	0.06	2	0.26	7
214[®]	0.02	1	0.22	7	0.05	1	0.35	9
230[®]	0.09	2	1.19	30	0.21	5	1.91	49
HR-120[®]	0.12	3	0.72	18	0.26	7	2.06	52

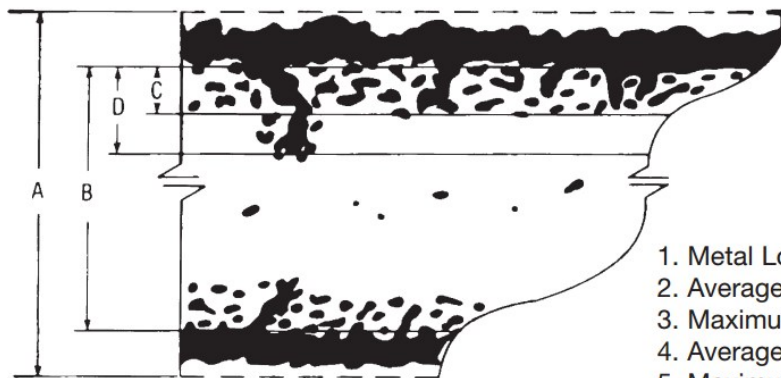
Amount of metal affected for high-temperature sheet (0.125") alloys exposed for 8640h (cycled monthly) in air + 10%H₂O

Comparative Cyclic Oxidation

Material	1400°F (760°C)		1600°F (871°C)		1800°F (982°C)		2000°F (1093°C)									
	Average Metal Loss		Average Metal Affected		Average Metal Loss		Average Metal Affected									
	Mils	µm	Mils	µm	Mils	µm	Mils	µm								
HR-224®	< 0.1	0.6	0.1	1.9	0.1	3	0.3	8	0.1	3	0.3	8	0.2	5	0.8	20
214®	< 0.1	0.3	0.1	1.6	0.1	3	0.1	3	0.1	3	0.5	13	0.1	6	0.4	10
230®	< 0.1	0.8	0.1	2.7	0.1	3	0.7	18	0.2	5	1.1	28	0.9	23	4.1	104
X	-	-	-	-	0.2	5	1.0	25	0.3	8	1.6	41	10	254	12.1	307
601	-	-	-	-	-	-	-	-	0.5	13	1.9	48	-	-	-	-
625	-	-	-	-	0.1	3	0.5	13	0.4	10	2.0	51	-	-	-	-
HR-120®	< 0.1	1.2	0.2	6.0	0.2	5	0.9	23	0.4	10	2.0	51	18.5	470	20.6	523
600	-	-	-	-	0.1	3	0.8	20	0.5	13	2.2	56	-	-	-	-
800HT	-	-	-	-	0.3	8	1.3	33	8	203	9.8	249	30.8	782	32.2	818

Amount of metal affected for alloys exposed to flowing air for 1000-h, cycled 1x/10h

Schematic Representation of Metallographic Technique used for Evaluating Oxidation



1. Metal Loss = $(A - B)/2$
2. Average Internal Penetration = C
3. Maximum Internal Penetration = D
4. Average Metal Affected = $((A - B)/2) + C$
5. Maximum Metal Affected = $(A - B)/2 + D$