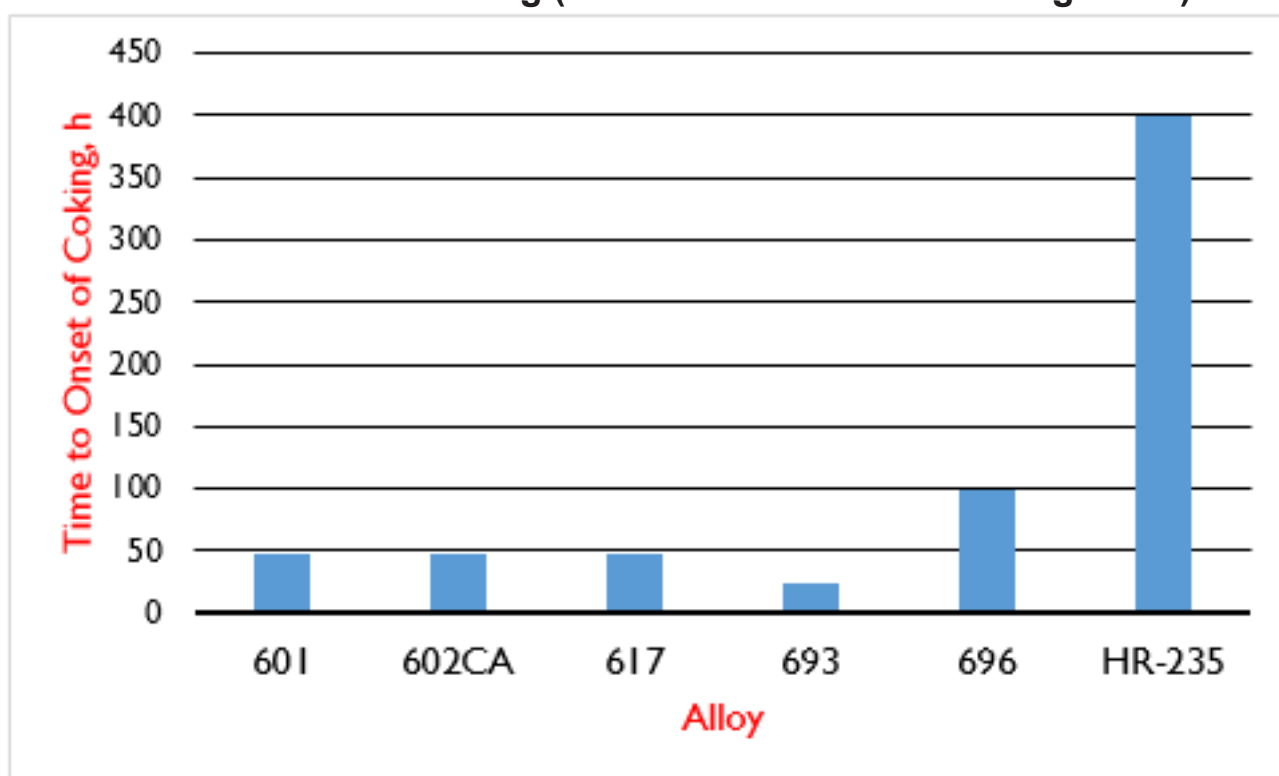


HAYNES® HR-235™ Alloy

Principal Features

A high-chromium, copper-bearing nickel alloy with outstanding resistance to metal dusting
HAYNES® HR-235™ has excellent resistance to metal dusting in carbonaceous high-temperature environments. Potential uses include applications in petrochemical production and syngas plants. Similar to other nickel-based corrosion resistant alloys, the alloy is readily fabricated and welded. HR-235™ alloy is being manufactured in several product forms including sheet, plate, pipe, tube, wire, billet and bar. Material will be available for trial evaluation as manufacturing progresses. Please contact Vinay Deodeshmukh at (765) 456-6212 or vdeodeshmukh@haynesintl.com for more information.

Time to Onset of Coking (in Accelerated Metal Dusting Tests)



Test Details:

- The alloys were tested in a flowing gas mixture of 68% CO + 26% H₂ + 6% H₂O at 680°C (ac = 2.9).
- The total test involved 1,200 cycles, each of one-hour duration (45 min at 680°C + 15 min cooling).
- The values for 696 and HR-235™ alloy are approximate.

Selected Corrosion Data

Hydrochloric Acid

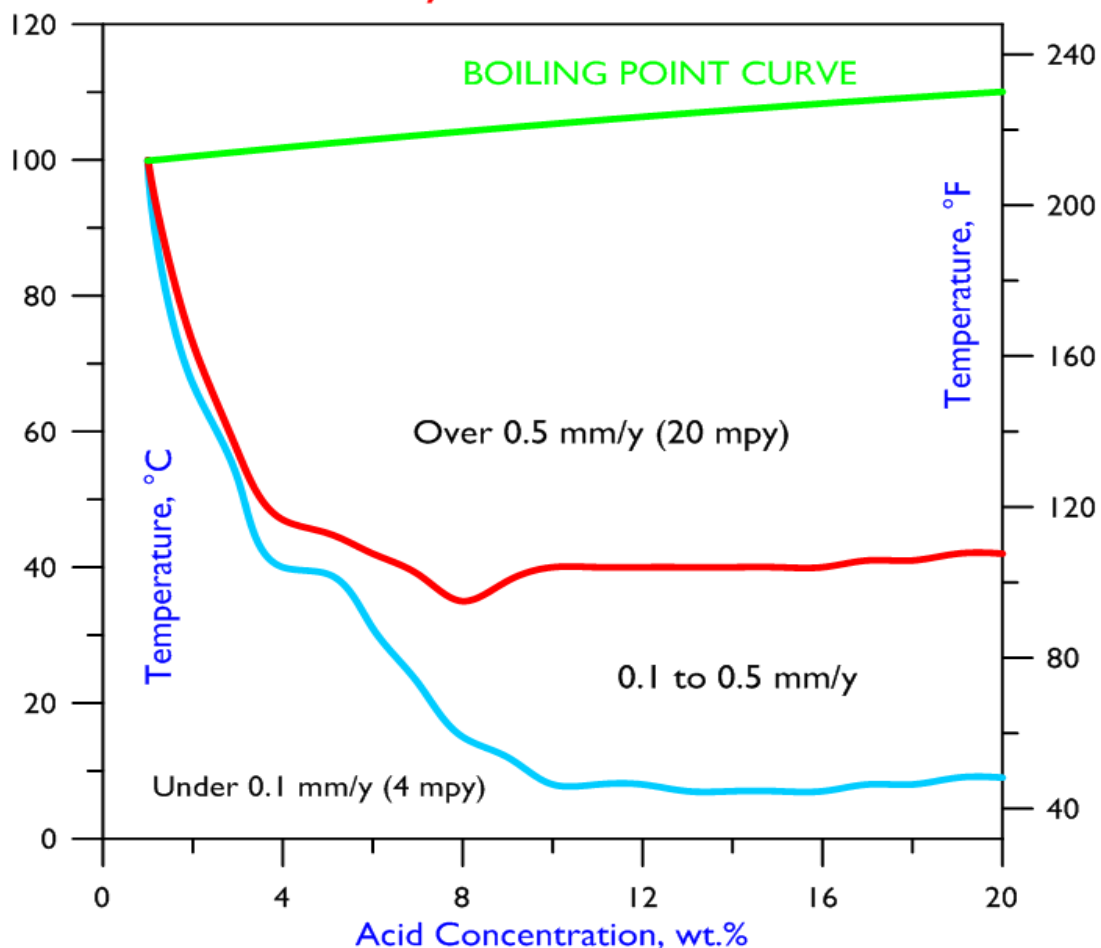
Conc. Wt.%	50°F	75°F	100°F	125°F	150°F	175°F	200°F	225°F	Boiling
	10°C	24°C	38°C	52°C	66°C	79°C	93°C	107°C	
1	-	-	-	<0.01	-	<0.01	<0.01	-	<0.01
1.5	-	-	-	-	-	-	-	-	-
2	-	-	-	<0.01	<0.01	0.92	-	-	-
2.5	-	-	-	-	-	-	-	-	-
3	-	-	-	<0.01	1.46	1.52	-	-	-
3.5	-	-	-	-	-	-	-	-	-
4	-	<0.01	<0.01	0.81	-	-	-	-	-
4.5	-	-	-	-	-	-	-	-	-
5	-	-	<0.01	0.98	1.29	1.5	-	-	-
7.5	0.04	0.21	0.57	-	-	-	-	-	-
10	0.12	0.24	0.36	1.18	-	-	-	-	-
15	0.13	0.26	0.38	1.26	-	4.04	-	-	-
20	0.11	0.22	0.28	1.05	-	-	-	-	-

All corrosion rates are in millimeters per year (mm/y); to convert to mils (thousandths of an inch) per year, divide by 0.0254.

Data are from Corrosion Laboratory Jobs 2-13 and 38-13.

All tests were performed in reagent grade acids under laboratory conditions; field tests are encouraged prior to industrial use.

Iso-Corrosion Diagram for HR-235 Alloy in Hydrochloric Acid



Selected Corrosion Data Continued

Nitric Acid

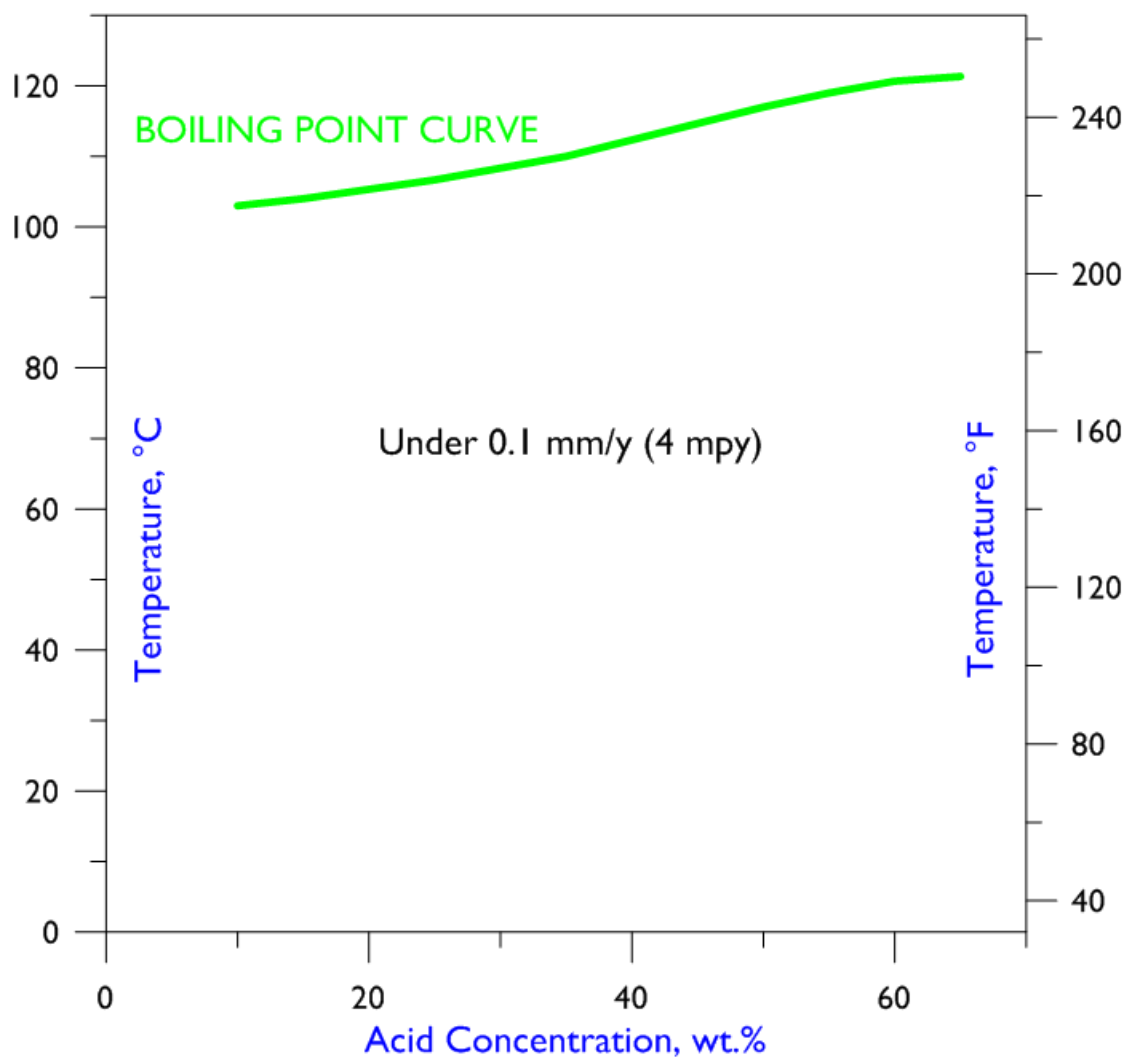
Conc. Wt.%	50°F	75°F	100°F	125°F	150°F	175°F	200°F	225°F	Boiling
	10°C	24°C	38°C	52°C	66°C	79°C	93°C	107°C	
10	-	-	-	-	-	-	-	-	<0.01
20	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	0.01
40	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	0.06
60	-	-	-	-	-	-	-	-	0.1
65	-	-	-	-	-	-	-	-	0.12
70	-	-	-	-	-	-	0.09	0.07	0.13

All corrosion rates are in millimeters per year (mm/y); to convert to mils (thousandths of an inch) per year, divide by 0.0254.

Data are from Corrosion Laboratory Jobs 10-13 and 38-13.

All tests were performed in reagent grade acids under laboratory conditions; field tests are encouraged prior to industrial use.

Iso-Corrosion Diagram for HR-235 Alloy in Nitric Acid



Selected Corrosion Data Continued

Sulfuric Acid

Conc. Wt.%	75°F	100°F	125°F	150°F	175°F	200°F	225°F	250°F	275°F	300°F	350°F	Boiling
	24°C	38°C	52°C	66°C	79°C	93°C	107°C	121°C	135°C	149°C	177°C	
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.08
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	0.14
10	-	-	-	-	-	<0.01	-	-	-	-	-	0.31
20	-	-	-	-	-	<0.01	-	-	-	-	-	0.49
30	-	-	-	-	-	<0.01	-	-	-	-	-	0.92
40	-	-	-	-	0.01	0.07	0.48	-	-	-	-	1.19
50	-	-	-	-	0.13	0.28	0.53	-	-	-	-	-
60	-	-	-	0.09	0.16	0.29	0.67	-	-	-	-	-
70	-	-	-	0.1	0.14	0.55	-	-	-	-	-	-
80	-	-	<0.01	0.19	0.36	0.66	-	-	-	-	-	-
90	-	-	0.08	0.13	0.61	1.58	-	-	-	-	-	-
96	-	-	-	-	-	-	-	-	-	-	-	-

All corrosion rates are in millimeters per year (mm/y); to convert to mils (thousandths of an inch) per year, divide by 0.0254. Data are from Corrosion Laboratory Jobs 2-13 and 38-13.

All tests were performed in reagent grade acids under laboratory conditions; field tests are encouraged prior to industrial use.

Iso-Corrosion Diagram for HR-235 Alloy in Sulfuric Acid

