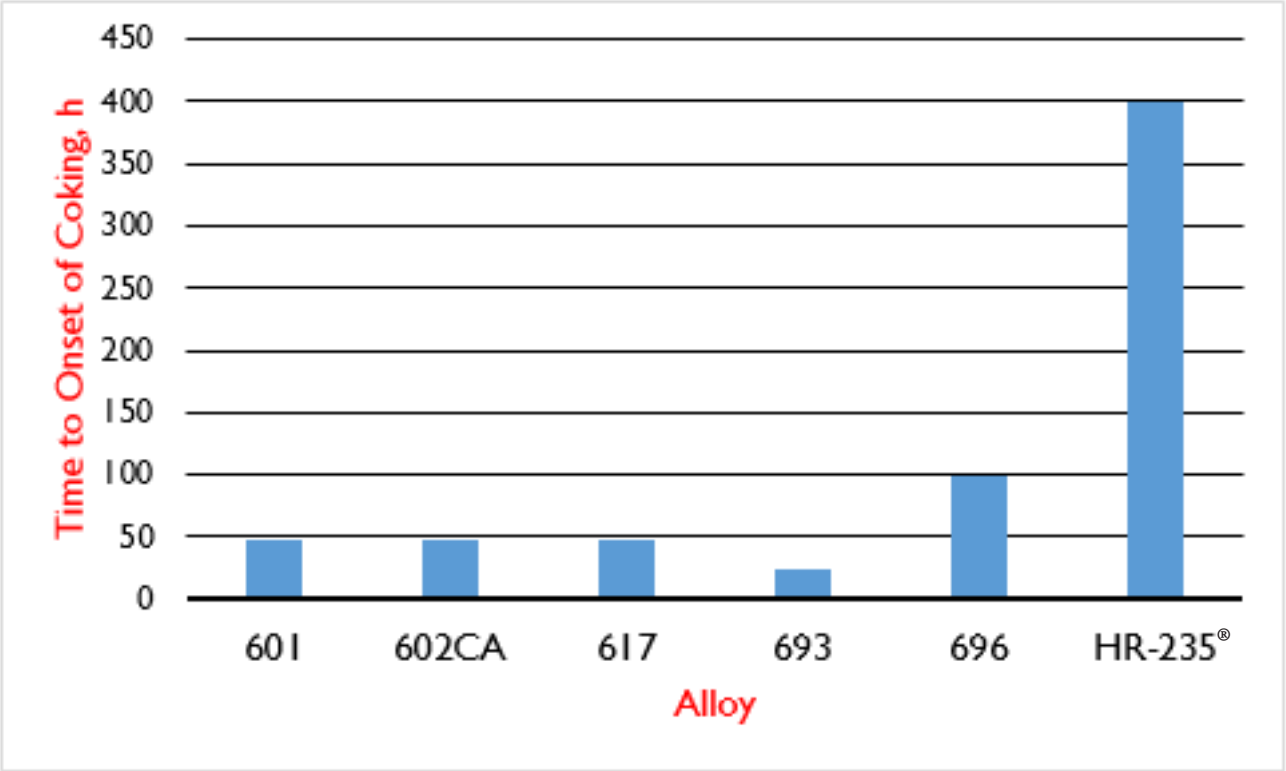
HAYNES® HR-235® Alloy

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.

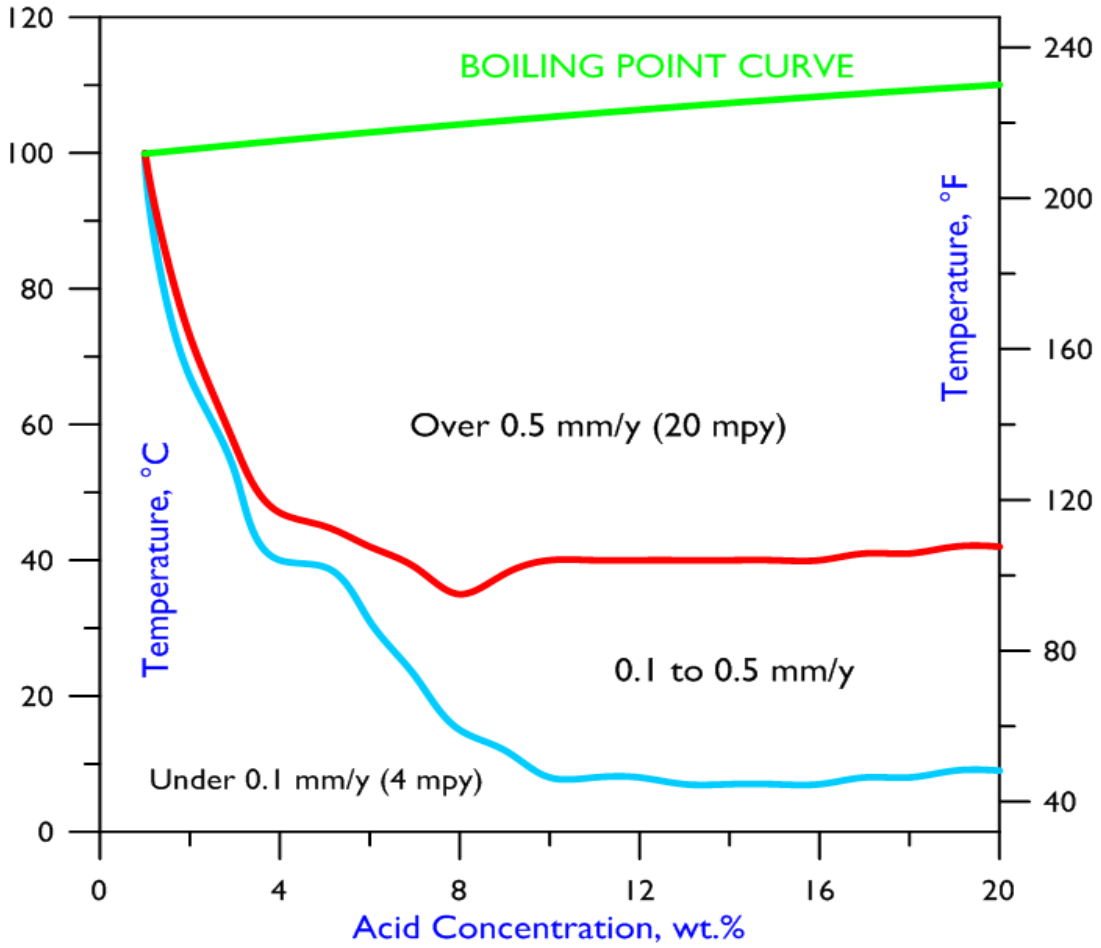
Selected Corrosion Data

Hydrochloric Acid

Conc. Wt.%	50°F 10°C	75°F 24°C	100°F 38°C	125°F 52°C	150°F 66°C	175°F 79°C	200°F 93°C	225°F 107°C	Boiling
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 10°C	75°F 24°C	100°F 38°C	125°F 52°C	150°F 66°C	175°F 79°C	200°F 93°C	225°F 107°C	Boiling
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.
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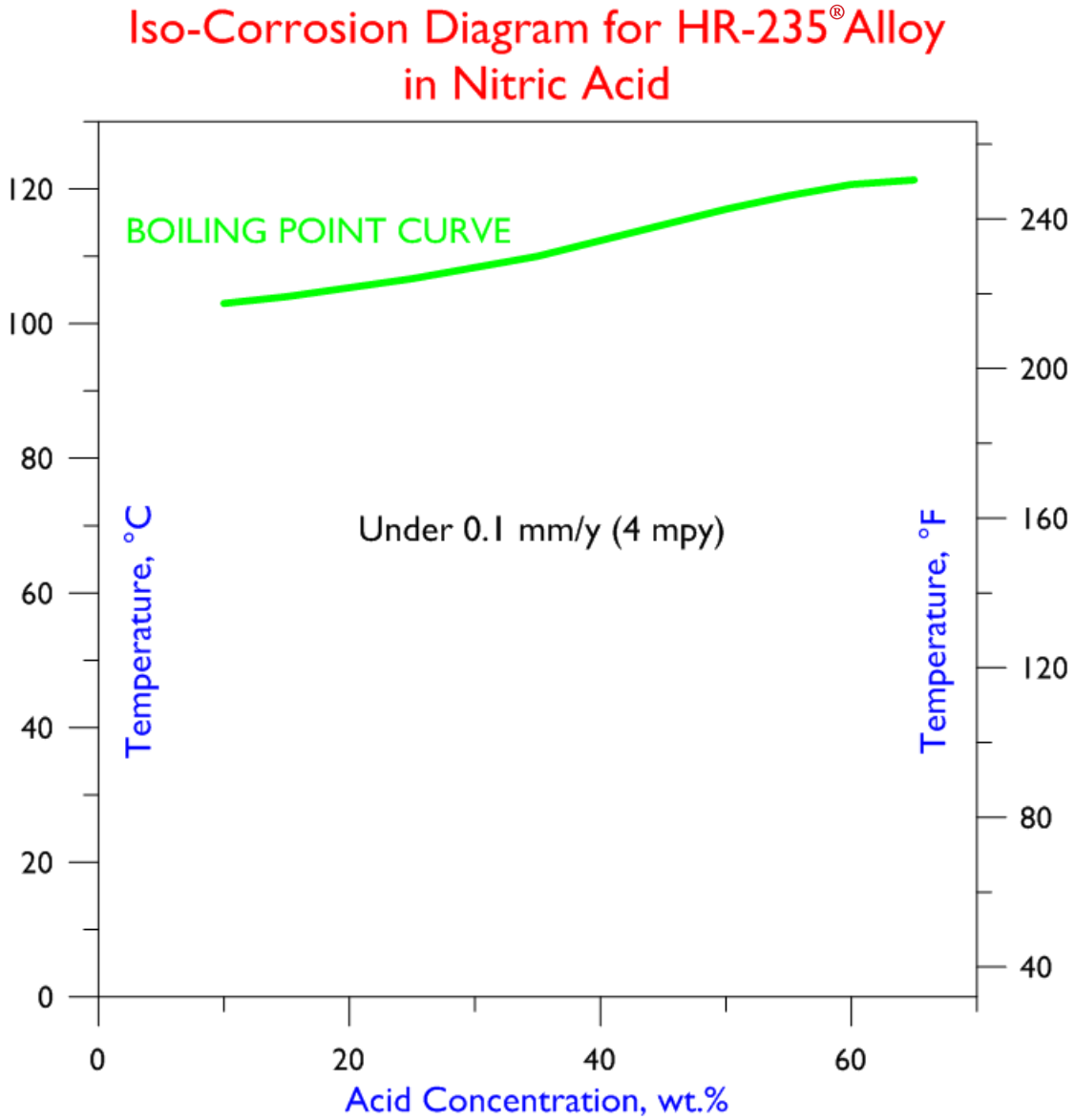

Selected Corrosion Data Continued

Sulfuric Acid

Conc. Wt.%	75°F 24°C	100°F 38°C	125°F 52°C	150°F 66°C	175°F 79°C	200°F 93°C	225°F 107°C	250°F 121°C	275°F 135°C	300°F 149°C	350°F 177°C	Boiling
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.
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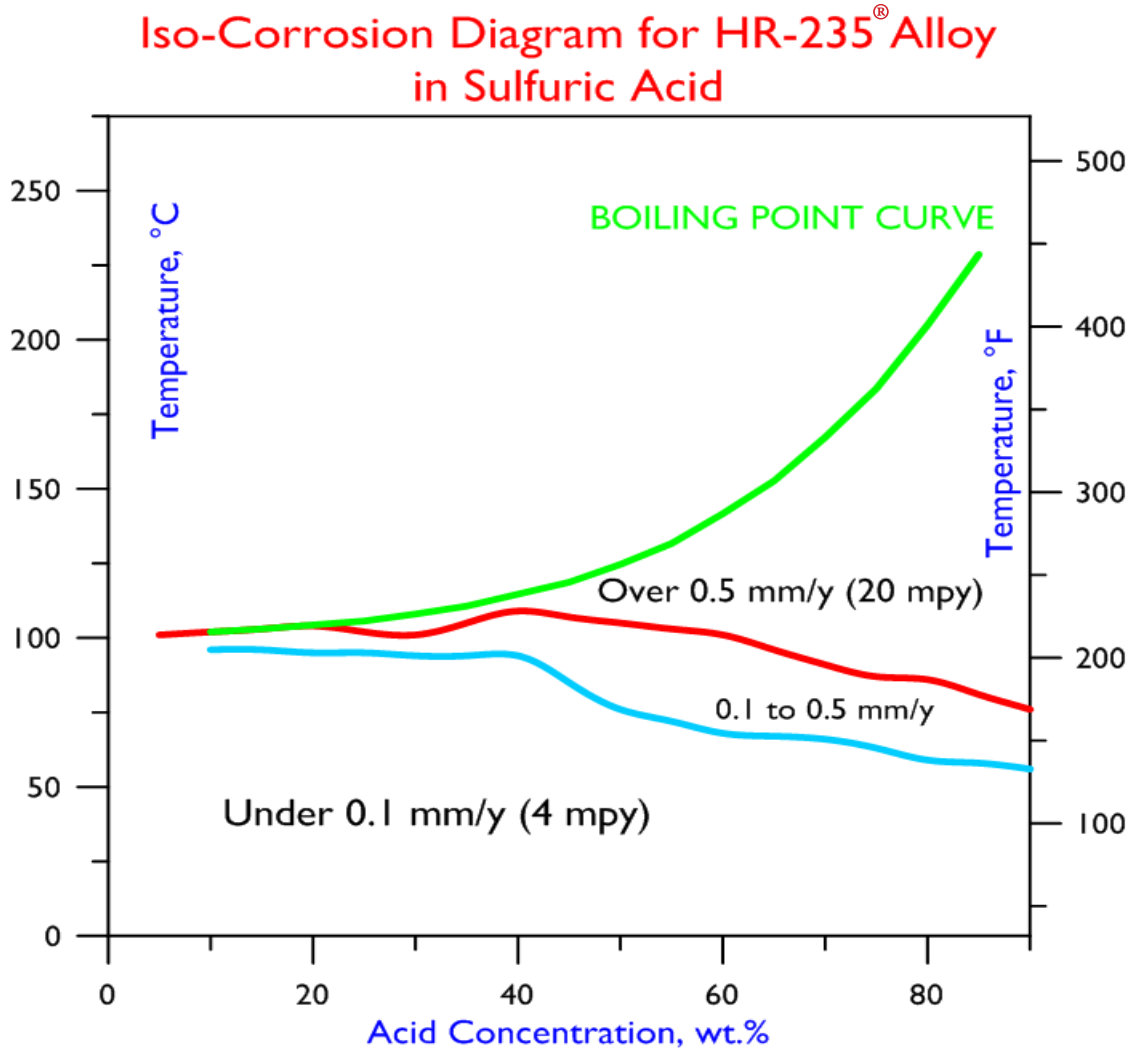

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For specific concentrations of elements present in a particular product and a discussion of the potential health affects thereof, refer to the Safety Data Sheets supplied by Haynes International, Inc.