

## Thermal Stability of High-temperature Alloys

### Tensile Ductility after Thermal Exposure

Thermal stability is an important design characteristic for engineering materials used at elevated temperatures. It may be defined as the resistance of an alloy to degradation of ductility and toughness when subjected to long-term thermal exposure. One common measurement of thermal stability is residual room temperature tensile elongation following such exposure. The following are test results for both plate and sheet materials exposed for 6,000 to 8,000 hours at different temperatures. Data are averages of at least two tests.

Alloy Form		Room Temperature Tensile Elongation Following 8,000 Hour Exposure at the Indicated Temperature (%)*			
		None	1200°F (650°C)	1400°F (760°C)	1600°F (870°C)
230®	Plate	50	38	35	36
S	Plate	54	50	46	53
625	Plate	46	18	13	26
X	Plate	47	18	20	26
188	Plate	56	29	11	22
556®	Plate	51	31	22	23
800H	Plate	58	35	-	-
X	Sheet	57	19	19	30
188	Sheet	62	32	9	15
S	Sheet	58	54	54	-
600	Sheet	37	38	39*	41*
601	Sheet	47	30	41*	43*
800H	Sheet	47	37	42*	40*

\* Data for 6,000 hour exposures are indicated with an asterisk

### Impact Strength after Thermal Exposure

Another common measurement of thermal stability is residual room temperature impact strength following long-term exposure at elevated temperatures. The following are results for impact tests performed upon samples exposed for 5,000 to 10,000 hours at different temperatures. The comparison includes values derived from multiple in-house tests and values taken from published data. Results are for Charpy V-Notch tests unless otherwise noted.

Alloy	Room Temperature Tensile Elongation Following 8,000 Hour Exposure at the Indicated Temperature (%)*							
	None		1200°F (650°C)		1400°F (1150°C)		870°C (1600°F)	
-	ft-lb	J	ft-lb	J	ft-lb	J	ft-lb	J
230®	54	73	30	41	28	21	28	21
S	140	190	54	73	65	48	142	105
625	81	110	5	7	7	5	20	15
X	54	73	15	20	11	8	20	15
188	143	194	23	31	4	3	14	10
556®	177	240	18	24	8	6	7	5
800H	239	324	81	110	-	-	-	-

<b>253MA</b>	110	149	13 <sup>(1)</sup>	18 <sup>(1)</sup>	22 <sup>(2)</sup>	16 <sup>(2)</sup>	-	-
<b>304*</b>	91	123	47 <sup>(3)</sup>	64 <sup>(3)</sup>	-	-	-	-
<b>316L*</b>	80	108	21 <sup>(3)</sup>	28 <sup>(3)</sup>	-	-	-	-
<b>310*</b>	75	102	2 <sup>(3)</sup>	3 <sup>(3)</sup>	-	-	-	-
<b>446</b>	1	1	1 <sup>(3)</sup>	1 <sup>(3)</sup>	-	-	-	-

\* Charpy Key Hole tests are indicated with an asterisk. All others are Charpy V-Notch tests.

(1) 5,000 Hour Exposure at 1292°F (700°C)

(2) 5,000 Hour Exposure at 1472°F (800°C)

(3) 10,000 Hour Exposures