Review of Developments in Plane Strain Fracture Toughness Testing (ASTM STP 463), W.F. Brown, editor, ASTM, 1972; pp. 233-237.

Corrected Fig. 6

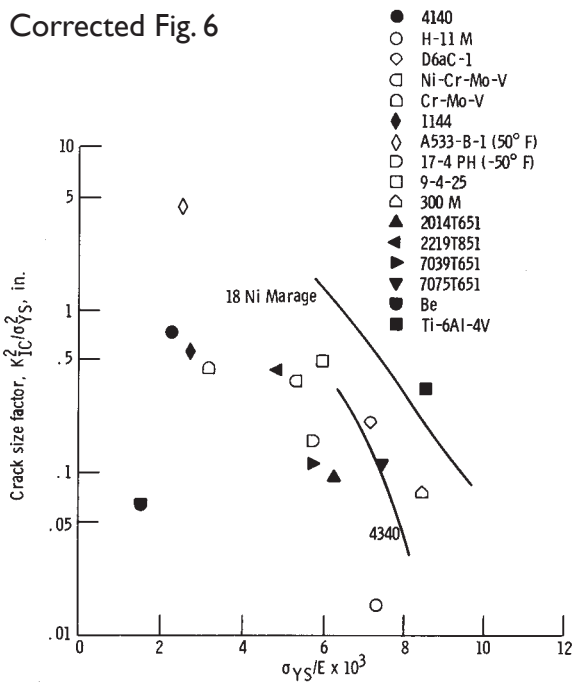


Figure 6. - Plane strain crack size factor for a variety of alloys in form of heavy plate or forgings. (See table I for further details).

TABLE 1.—*Alloys in the form of plate and forging for which valid K_{Ic} data is available.*

Alloy	Reference[c]	Form	Condition[d]	Direction[e]	F_{tu}, ksi
Steels:					
AISI 4140	10	4 by 24 by 60-in. plate	1550 F, OQ + 1200 F, 6 h, FC	RW	65
A533-B-1[a]	12	12 by 120 by 260-in. plate	1675 F, AC + 1600 F, 4 h, WQ + 1225 F, 4 h, FC + 1150 F, 40 h	RW	72
AISI 1144	10	4 by 10 by 12-in. forging	1550 F, OQ + 900 F, 6 h, FC	WR	78
Cr-Mo-V	13	34-in.-dia forged rotor	1775 F, AC + 1240 F, 40 h	axial MR	93
Ni-Cr-Mo-V	13	65-in.-dia forged rotor	1550 F, AC + 1090 F, 40 h	axial MR	154
17-4PH[b]	...	5 by 9 in. forging	1100 F, 4h, age	RT	162
9-4-25	11	3-in. forged plate	1550 F, 2 h, OQ + 1000 F (2 + 2) h	WR	175
D6aC-1	14	3½-in plate	1700 F, 1½ h, SQ 975 F, 2 h, OQ + 1025 F (2 + 2) h	...	207
D6aC-2	14	3½-in. plate	1650 F, 1½ h, SQ 975 F, 2 h, SQ 450 F 2 hr + 1025 F (2 + 2) h	...	207
H-11M	...	1-in. plate	1850 F, 1 h, OQ + 1080 F, 1 h	...	213
4340	...	1-in. plate	1550 F, ½ h, OQ + 500 to 900 F, 1 h	RW	238 to 182
300M	...	4½ by 4½-in. forging	1600 F, SQ, 1000 F, 1 h, OQ, 110 F, ½ h, AC + 575 F (2 + 2) h	RW	243
18Ni marage 250 grade	4	2-in. plate	1500 F, AC + 725 to 850 F, 6 h	RW	190 to 253
Aluminums:					
2219	...	1.4-in. plate	T851	WR	51
7039	10	4 by 12 by 10-in. forging	T651	WR	57
2014	...	1.8-in. plate	T651	RW	66
7075	...	1⅜-in. plate	T651	WR	78
Others:					
Be	...	1 by 16-in.-dia forging	75% upset at 1400 F	center radial	66
Be	...	Hot pressed	...	...	39
Ti-6-4[f]	15	3-in. forged plate	1000 F age	WR	140

(*Continued*)

TABLE 1—*Alloys in the form of plate and forging for which valid K_{Ic} data is available.*—Continued

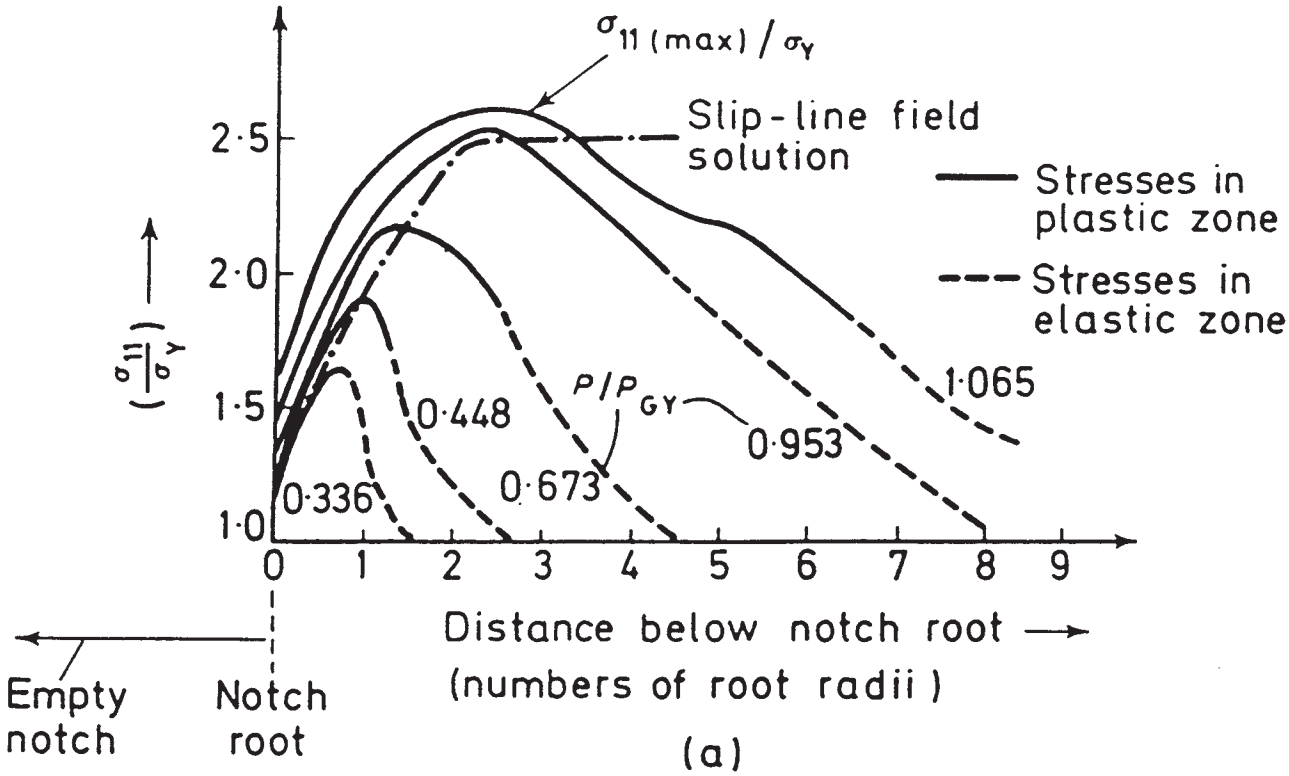
Alloy	F_{tu}, ksi	Composition, percent by weight							
		C	Mn	P	S	Si	Ni	Cr	Mo
Steels:									
AISI 4140	101	0.42	0.78	0.007	0.023	0.23	0.22	0.89	0.21
A533-B-1[a]	93	0.24	1.42	0.01	0.017	0.22	0.70	...	0.50
AISI 1144	122	0.52	1.46	0.016	0.025	0.20	...	...	...
Cr-Mo-V	117	0.31	0.78	0.009	0.010	0.28	0.07	1.10	1.15
Ni-Cr-Mo-V	174	...	...	...	...	...	...	...	...
17-4PH[b]	167	0.07 max	1.0 max	0.040 max	0.030 max	1.0 max	4	17	...
9-4-25	...	0.26	0.33	0.008	0.008	0.01	8.41	0.40	0.48
D6aC-1	233	0.43	0.85	0.65	0.025 max	0.025 max	0.75	0.90	0.50
D6aC-2	232	...	...	...	...	...	...	...	...
H-11M	261	0.39	0.31	0.016	0.010	...	...	...	...
4340	280 to 194	0.42	0.71	0.010	0.012	0.25	1.77	0.80	0.23
300M	295	0.41	0.81	0.007	0.003	1.77	1.85	0.83	0.40
18Ni marage 250 grade	192 to 263	0.006	0.06	0.006	0.007	0.01	18.5	...	4.81
Aluminums:									
2219	67	...	0.3	...	...	0.20 max	...	...	...
7039	65	...	0.25	...	...	0.30 max	...	0.20	...
2014	69	...	1.0	...	...	1.0	...	0.10 max	...
7075	86	...	0.3 max	...	...	0.5 max	...	0.3	...
Others:									
Be	84	...	...	...	...	...	...	...	...
Be	46	...	...	...	...	...	...	...	...
Ti-6-4[f]	150	0.023	...	...	...	...	...	...	...

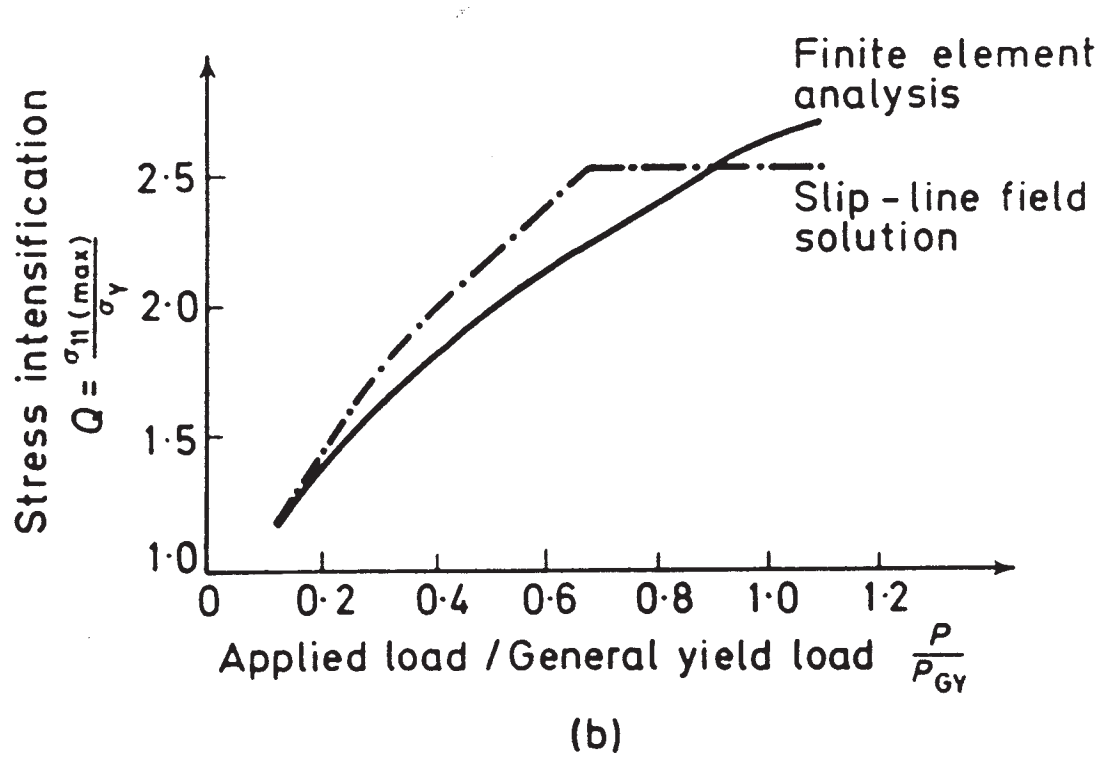
[a] Tested at 50 F.
[b] Tested at −50 F.
[c] NASA-Lewis unless otherwise indicated.
[d] OQ = oil quenched; FC = furnace cooled; AC = air cooled; SQ = slack quenched

TABLE 1—*Alloys in the form of plate and forging for which valid K_{Ic} data is available.*—Continued

Alloy	Composition, percent by weight								
	V	Co	Al	Ti	Fe	Cu	Mg	Zn	Zr
Steels:									
AISI 4140	...	...	...	...	bal.	...	...	...	...
A533-B-1[a]	...	...	...	...	bal.	...	...	...	...
AISI 1144	...	...	...	...	bal.	...	...	...	...
Cr-Mo-V	0.26	...	...	...	bal.	...	...	...	...
Ni-Cr-Mo-V	...	...	...	...	bal.	...	...	...	...
17-4PH[b]	...	...	...	...	bal.	...	...	...	...
9-4-25	0.70	3.9	...	...	bal.	...	...	...	...
D6aC-1	0.03	...	...	...	bal.	...	...	...	...
D6aC-2	...	...	...	...	...	...	...	...	...
H-11M	...	...	...	...	bal.	...	...	...	...
4340	...	...	...	...	bal.	...	...	...	...
300M	0.08	...	...	...	bal.	...	...	...	...
18Ni marage 250 grade	...	7.4	0.11	0.40	bal.	...	...	...	...
Aluminums:									
2219	...	...	balance	0.06	0.30 max	6.3	0.02 max	1.0 max	0.18
7039	...	...	balance	1.1 max	0.40 max	0.10	2.8	4.0	...
2014	...	...	balance	0.15 max	1.0 max	4.5	0.5	0.25 max	...
7075	...	...	balance	0.2 max	0.7 max	1.6	2.5	5.6	...
Others:									
Be	...	...	...	...	...	...	...	...	...
Be	...	...	...	...	...	...	...	...	...
Ti-6-4[f]	4.1	...	6.3	bal.	0.13	...	...	...	...

[e] First letter indicates direction of normal to crack plane and second letter indicates direction of crack propagation: R = finish rolling or forging direction; W = width direction of plate or of rectangular cross-section forging; T = thickness direction of plate or rectangular cross-section forging; MR = midradius.
[f] Other elements: 0.004 H_2, 0.17 O_2.





Finite element analyses of stress below a deep notch in pure bending. (a) Variation in maximum principal stress, normalized by yield stress, with distance below notch root for various applied loads (as normalized by general yield load). (b) Dependence of stress intensification Q on applied load, using the von Mises yield criterion.

J.R. Griffiths and D.R.J. Owen, *J. Mech. Phys. Solids*, vol. 19, p. 419 (1971).