$$\alpha_r = \frac{(\sigma)_r}{\sigma_1}, \qquad \alpha_m = \frac{(\sigma)_m}{\sigma_1} \qquad (10a, b)$$

where $(\sigma)_r$ is the semirange in stress, $(\sigma)_m$ is the mean stress*, and σ_1 is less than or equal to the ultimate tensile strength depending upon the factor of safety desired. In order to get some estimations of what values α_r and α_m may be, some data from the literature are tabulated in Tables XLII, XLIII, and XLIV. These data are for rotating-beam and push-pull tests.

The fatigue life again is found to depend on the range in stress and the mean stress, and upon the temperature. This dependence is illustrated in Figure 42 for 10^4 to 10^5 cycles life in terms of the parameters α_r and α_m. (Points (α_r, α_m) above the curves in Figure 42 would correspond to $<10^4$-10^5 cycles life and points below the curves would correspond to $>10^4$-10^5 cycles life.) The 1000 F temperature data are for Vascojet 1000. Although α_r increases with temperature for this steel, the ultimate tensile strength decreases and the fatigue strength at 10^4 to 10^5 cycles for $\alpha_m = 0$ remains nearly constant over the temperature range of 75 F to 1000 F.

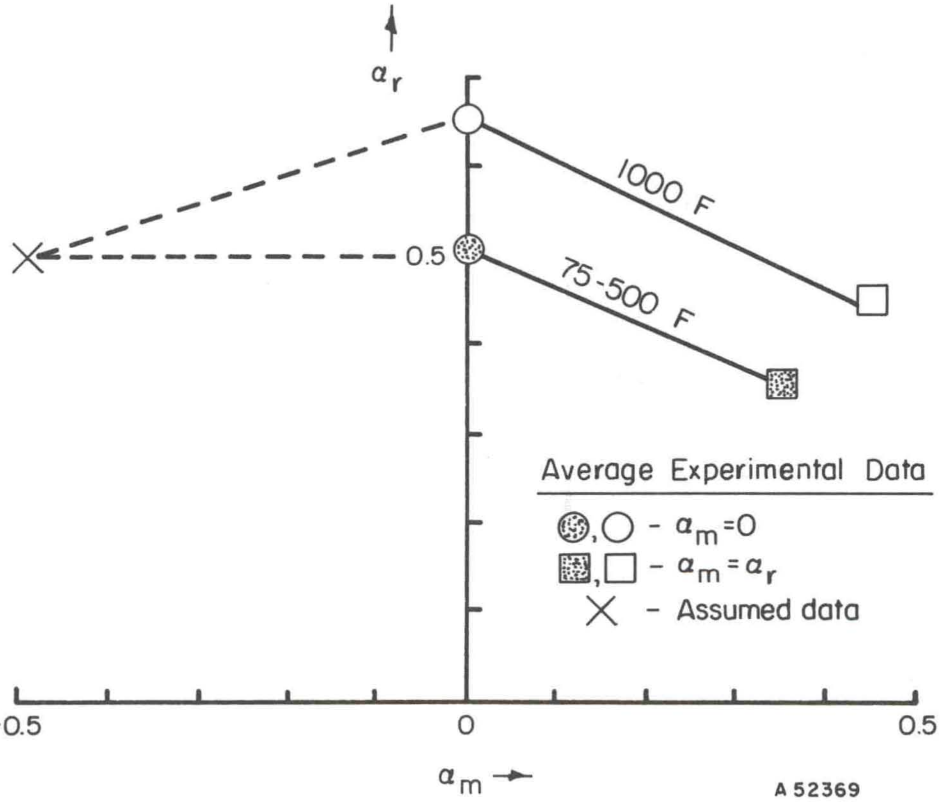

FIGURE 42. FATIGUE DIAGRAM FOR 10^4-10^5 CYCLES LIFE FOR HIGH-STRENGTH STEELS AT TEMPERATURES OF 75 F TO 1000 F

α_r and α_m are defined by Equations (10a, b)

*$(\sigma)_r$ and $(\sigma)_m$ are defined by expressions similar to Equations (6a, b) for S_r and S_m.

TABLE XLII. FATIGUE STRENGTHS OF HIGH-STRENGTH STEELS FROM ROOM-TEMPERATURE ROTATING-BEAM TESTS, $\alpha_m = 0$

Material	Reference	Ultimate Tensile Strength, ksi	Yield Tensile Strength, ksi	α_r, Stress Range Parameter[(a)], for Cycles			
				10^4	10^5	10^6	10^7
18% Ni maraging steel	(36)	300	280		0.49	0.43	0.41
	(37)	300	285		0.33	0.31	0.30[(b)]
	(38)	295	285	0.68	0.44	0.38	0.36
		270	265	0.74	0.43	0.37	0.37
H-11 (CEVM)	(38)	250-280	210-230	0.75	0.57	0.54	0.54
D6AC	(39)[(c)]	270	237	0.66	0.41	0.37	0.37
Vascojet 1000	(39)[(c)]	309	251		0.45	0.29	0.29

(a) $\alpha_r \equiv (\sigma)_r/\sigma_u$, $\alpha_m \equiv (\sigma)_m/\sigma_u$, where $(\sigma)_r$, $(\sigma)_m$, σ_u are the semirange, mean, and ultimate tensile stresses, respectively.
(b) These are stated to be 90 percent probability data.
(c) Tests in Reference (39) were push-pull tests with, $\alpha_m = 0$.

TABLE XLIII. FATIGUE STRENGTHS OF HIGH-STRENGTH STEELS FROM ROOM-TEMPERATURE PUSH-PULL TESTS, $\alpha_m = \alpha_r$

Material	Reference	Ultimate Tensile Strength, ksi	Yield Tensile Strength, ksi	α_r, Stress Range Parameter[(a)], for Cycles			
				10^4	10^5	10^6	10^7
18% Ni maraging steel	(38)	295	285	0.40	0.25	0.22	0.22
		270	265	0.43	0.28	0.25	0.24
H-11 (CEVM)	(38)	280-300		0.38	0.31	0.29	0.29
D6AC	(39)	270	237	0.44	0.33	0.28	0.28
Vascojet 1000	(39)	309	251		0.33	0.27	0.19

(a) $\alpha_r \equiv (\sigma)_r/\sigma_u$, $\sigma_m \equiv (\sigma)_m/\sigma_u$, where $(\sigma)_r$, $(\sigma)_m$, σ_u are the semirange, mean, and ultimate tensile stresses, respectively.