EXPRESS ESTIMATION OF PARAMETERS OF FATIGUE RESISTANCE

Mylnikov V.V.[1], Shetulov D.I.[2], Pronin A.I.[3], Kondrashkin O.B.[1], Chernyshov E.A.[2]
(Nizhny Novgorod State University of Architecture and Civil Engineering)[1],
mrmylnikov@mail.ru
(Nizhny Novgorod State Technical University n.a. R.E. Alekseev)[2]
(Komsomolsk-on-Amur State Technical University)[3]

Tests of machined cylindrical samples of cadmium on fatigue for three values of cyclic loading frequency ω [1-3]. The obtained data presented in figure show an increase in cyclic strength with increasing ω (Fig. 1).

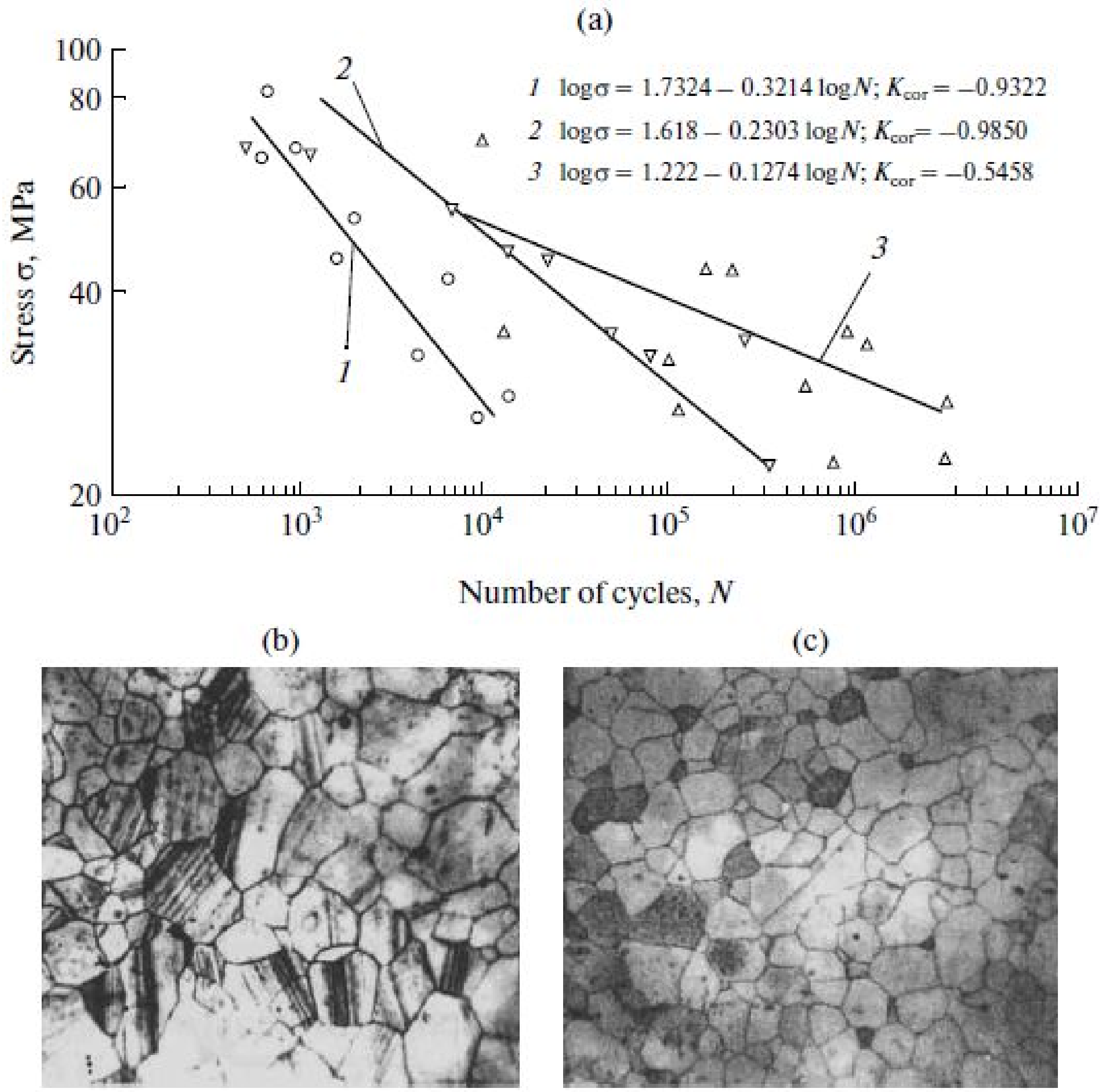

Fig. 1. (a) Fatigue curves and (b, c) microstructure of cadmium at $t = 20°C$. (a) ω, Hz: (*1*) 0.033, (*2*) 1.0, and (*3*) 46.7; (b, c)(x 600) $\sigma = 36$ MPa, $N = 10^3$, ω = (b) 0.033 Hz and (c) 46.7 Hz

Apply the interpolation function for the experimental parameter dependencies of the fatigue resistance of the material to the frequency of loading cycles, i.e. $tg\alpha_w=f(\omega)$. These dependences allow one to determine the value $tg\alpha_w$ at any frequency of load cycles within those experimental data are available. In other words, there is no need to conduct the experiment, if the frequency of the loading cycles it is not, but the value of ω is included in the range of values for which experimental data are. The mathematical expression for this purpose looks like this:

$$tg\alpha_w=G_0 + G_1 (\omega-\omega_0) + G_2 (\omega-\omega_0) (\omega-\omega_1), \quad (1)$$

continue to expand it:

$$\text{tg}\,\alpha_{w_{\omega_0}} = G_0; \ \text{tg}\,\alpha_{w_{\omega_2}} = G_0 + G_1(\omega_2+\omega_0) + G_2(\omega_2-\omega_0)(\omega_2-\omega_1); \quad (2)$$

$$\text{tg}\,\alpha_{w_{\omega_1}} = G_0 + G_1(\omega_1+\omega_0); \quad (3)$$

$$G_1 = \frac{\text{tg}\,\alpha_{\omega_1} - G_0}{\omega_1-\omega_0}; \quad (4)$$

Taking the experimental data for cadmium in Fig. 1 and assigning the relevant values ω_i and $tg\alpha_{w_i}$ we have:

ω_0=0, 033; ω_1=1; ω_2=46, 7 Гц;

$\text{tg}\,\alpha_{w_{\omega_0}} = 0{,}3214$; $\text{tg}\,\alpha_{w_{\omega_1}} = 0{,}2303$; $\text{tg}\,\alpha_{w_{\omega_2}} = 0{,}1247$

The calculation will get the coefficients of the expression:

$G_0=0{,}3214$; $G_1= - 9{,}4238\cdot10^{-2}$; $G_2=1{,}9724\cdot10^{-3}$.

Substituting the numerical values into the expression (1) we get:

$$tg\alpha_w(\omega)|_{Cd}= 0{,}3246 - 9{,}6276\cdot10^{-2}\omega + 1{,}9724\cdot10^{-3}\omega^2. \quad (6)$$

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