Some semi-phenomenological approaches to description of microcracks formation in solids

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We present some semi-phenomenological models of crack formation in solids. It is shown that microcracks with typical lengths $L < L_{min}$ are being healed due to the thermally activated surface diffusion processes, while at the length $L = L_{max}$, at which a maximum of the total energy of the microcrack $U(\varepsilon, L)$ occurs, there is an instantaneous material destruction. Both lengths are found to have a power law dependence $L_{min} \sim c_{min}\varepsilon^{-\alpha}$, and $L_{max} \sim c_{max}\varepsilon^{-\beta}$, where ε denotes a strain in the vicinity of the microcrack.

We also consider a model with possible penetration of a *guest*-particle inside a defect. Mutual repulsion between *host*- and *guest*-particles leads to appearance of metastable defects in the solid. A stability of such microcracks with respect to temperature fluctuations grows in a certain domain of ε and then decreases. An additional assumption of possible bridge formation between *host*- and *guest*-particles extends this region and enlarges the activation energy of crack formation. The "window" of strains, at which the stable microcracks are being formed, also becomes wider.

Carried out qualitative analysis seems to be quite perspective for further calculations of nucleation and growth times of microcracks as well as distribution of characteristic lengths of the defects.