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THEORETICAL CONSIDERATION CONCERNING CRACK OF SHAFTS

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ABSTRACT
The crack of shafts and of many other mechanisms is often met, but the causes and unfolding way of the process are rarely cleared up entirely. The paper presents some theoretically aspects of shafts' cracking.
Keywords: Segregations at the limits , connection forces, crack of material., dynamic equilibrium of I dislocations, tenacity test ductile crack.

I INTRODUCTORY NOTIONS

Theoretical resistance to rupture of crystalline materials is established by intensity of cohesive interatomic forces. The cohesive forces are resulted from the equilibration of two actions with opposite effects: a) the attraction effect between atoms which result from low energy state of valence electrons; b) rejecting effect. That is a consequence of Pauli's exclusion principle, which is allowed when complete electronic coatings of atoms tend to interpenetrate each other according as the distance between two neighboring atoms is diminished. These effects are materialized through attraction and rejecting forces which vary with interatomic distance - figure 1 [2].

The position which is marked by x = Co (for which the resultant forces is null) establishes the equilibrium position, the interatomic equilibrium position, respectively.

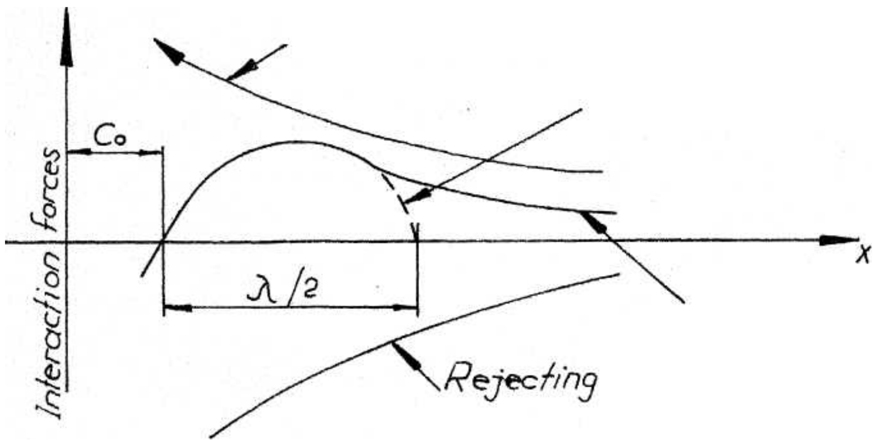
The separation of two atoms supposes their pulling from equilibrium position through the increasing of the distance Xi. This fact can be realized through application of some outside forces which must defeat the reaction of the interatomic connection forces.

Application of the outside increased forces, the equilibrium reversible process between the applied tension and interatomic connection force, evolved till touching theoretical resistance σ_{t10} (which corresponds to the maximum of the connection force (figure 1) when the process becomes irreversible).

The increasing of the interatomic distance is done with diminution of the applied force. The connection forces vary with distance.

It is a periodical function, so it is possible to approximate it with a sine function having λ period.

The crack of the materials is a complex phenomenon; its appearance and its unfolding are ruled by many factors.



Attraction forces Sine approximation Connection forces
Figure 1. The appearance of interaction forces

The process of the crack in crystalline materials is unfolded in two phases [2].

- The initiation of the microfissures through the mechanisms established by static and dynamic equilibrium of dislocations.
- The development of the microfissure in macroscopic fissures.

Generally, the first phase is controlled by tangential component of the stress in favorable plans of the movement of the dislocations.
Mainly, the .second phase is controlled by the normal component of the stress.

2 DECISIVE FACTORS OF THE SPECIFIC TENACITY WEATCKES

For the application of the crack mechanic it is important to know the tenacity features as following of: elaboration thermal treatment heat - working or cold - working process or at welding point.
Although at present many experiments are unfolded, only for few materials, the specific tenacity features are satisfying known. This fact is due to the extreme sensibility of these specific features to the macrostructure and to the impurities which can be different even the same mark of materials.
So, often, practically, the tenacity tests for every case are done.
First of all, the tenacity of pearlitic - ferrite steels (the concentration of carbon: 0,05 - 0,20 % and some percentage of alloying elements) is established by ratio between ductile ferrite and flinty pearlite. Simultaneously with increasing of concentration of ferrite grains the size of ferrite grains increase, and in accordance with [2], the yield limit, σ_c increases, too.
At pearlitic - ferrite steels, the treatments with slow coding (which lead to the precipitation of the iron carbides at the limit of ferrite grains) have as result the diminution of the tenacity. Thus it is explained how at pearlitic - ferrite steels a greater tenacity is obtained for the hardening treatment comparatively with normalizing or annealing treatments. The inclusion has an important role both in initiation of fissure through exploitation and initiation and coalescence of the holes in ductile crack process.
For example in usual carbon steel the inclusions of MnS with oblong shape lead to the diminution of the tenacity comparatively with the situation when the inclusion of MnS have spheroid shape obtained through adding of the modifiers like rare earths.
The tenacity of material is influenced a lot by the termomecanic treatments which were done during elaborating.
The laminating process of pearlitic - ferrite steels has an important contribution for establishing of tenacity specific features. Thus, the laminating produces a strong anisotropy in tenacity specific features. This fact is own to orientation of the limits of grains, to the inclusions and to the pearlitic formations.
Many references were done for pearlitic - fertile steels with a concentrations of 0,28 % C. In hypereutectoid steels with a concentration of carbon between 0,28 % - 0,8%, pearlite is presented in a polycrystalline shape. It is the principal constituent.
The pearlite, having a smaller deformation capacity, forces the deformation of ferrite; so, an increasing of yield limit and a diminution of tenacity are greater when the pearlite concentration h greater [2].

3. CONCLUSIONS

When the concentration of pearlite increases, the initiation of crack is transferred from ferrite grains to pearlite grains.

In this case the research [2], certify that effective size of the grain for initiation of fissure isn't the size of pearlite size; it is the size of initial austenitic grain.

This finding suggests the possibility that we can improve tenaciousness characteristics finishing the austenitic grain.

4. REFERENCE

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