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STRENGTH CHARACTERISTICS EVALUATION OF CAST WHEELS ACCORDING TO THEIR MICROSTRUCTURE

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One of the wishes of theconsumers is the high stiffness of the tire to shocks against the roadroughness.For the most part existing experimental procedures to shock resistance haven't got tire deflection measure during the impact in estimation tests, which are the most obvious. The test bench for such procedures is a combination of free-falling load and the bearing part. The impact was made out of the insiderim edge. Wheels are made of siluminin Russian and foreign companies. As the matter of fact it is not always convenient to use the bench for determination of the wheels quality.

The study set the analysis problem of conformity the strength characteristics of the wheels per the quantitative characteristics of structural constituents.

The research samples were cut from the tangible cast wheels of AK7 and AK12 alloys (silumins).

Eutectic and eutectoid's microparticlesare complex formations with imbedded particles of another phase in the core (silicon plates in an aluminum matrix).

Alloy properties are defined by the shape and size of phases which compose eutectic.

Each phase is a geometric solid microscopic scale, which has a very definite shape and parameters - linear dimensions, the quantity of a surface, volume and etc. It is natural to take advantage of these geometric quantities for assessment of the microscopic particles and phase components of the structure as a whole as their entirety. However, in the amount of the study metal it is hardly ever possible to find at least two microparticles, completely identical in shape and size, so it is possible to speak only about using the statistical average valueof geometric parameters.

The present study problem was the surface determination and the balling-up degree of silicon phase.

It is known that as the dimensioning specification of the eutectic silicon particles a maximum Fere diameter (D_{Fmax})can be used –which meansthe maximum length of possible particle projections on an arbitrary axis.

The balling-up degree of silicon particles is evaluated by Fere ratio (F), which is estimated as follows:

$$\Phi = D_{F_{min}} / D_{F_{max}} \ ,$$

Where$D_{F_{min}}$is the minimum length of possible particle projections on an arbitrary axis, μm (a minimum Fere diameter).The closer the ratio of Fere closer to one, the closer the particle shape to spheroidal.

To determine the particle size of silicon phase even with microscope magnification of x1500 is possible, but it is very hard.

It was decided by the authors to use the computer program «Analyz», which was made in the departments of Siberian Federal University "Metallography and Heat Treatment of Metals"and "Applied Mathematics and Automated Control System ", which allows calculating the particles surfaces.

It was taken into consideration that the image which is obtained by shooting from apolished section depends on the angle at which the cut was made on the sample. It was assumed that cross-sectional silicon dendritic branches are rectangular in shape (Fig. 1), and the minimumvalue will correspond to the cross-section ofdendritic branches of the second order.

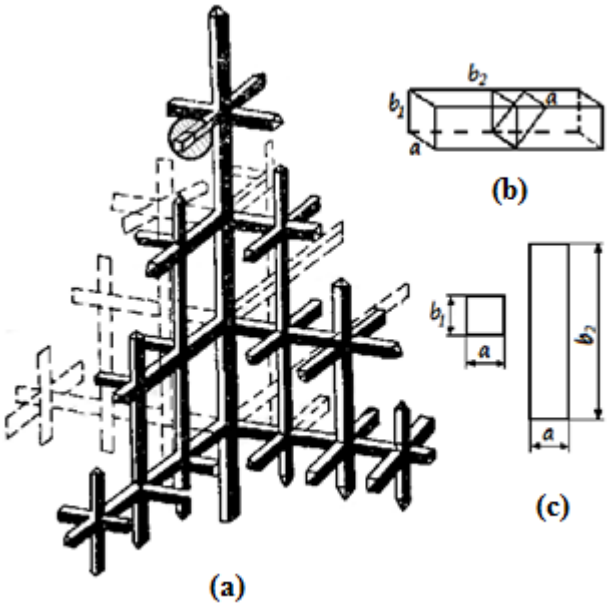

Figure 1 - Structure of pine-tree crystal (a) and the dendritic branches (b) with the description of the cross and long section (c)

$$S_{min} = ab_{Fmin}, \qquad S_{max} = ab_{Fmax}.$$

Substituting the values of surfaces, therelations equalityis obtained:

$$\frac{S_{min}}{S_{max}} = \frac{ab_{Fmin}}{ab_{Fmax}} = \frac{b_{Fmin}}{b_{Fmax}} (1)$$

The minimum cross sectional surface of the silicon particle, which shape is changed during the balling-up process, herewith the diameter is equal to the width of the particle rectangular cross-section, represents a square, so the formula will be as follows:

$$S_{min} = a^2$$

The results of determining the parameters of the silicon particles surface and the Fere criterion will be able to be taken as the basis for the conclusion about the quality of the wheels, upon the strength, hardness and deflection.