\[ I_2(\epsilon) = d^2 \sum_{n=0}^{3} A_n \int_{-\infty}^{+\infty} L(E - \epsilon) \mu_n^2(E) \, dE, \]

where \( A_n \) are positive constants. When \( n = 2 \), a Lorentzian line with a total width \( =1.4\Gamma \) is obtained. Convolution of a large number of Lorentzian functions gives an even narrower line, and subtraction of the narrow line from the broad Lorentzian line always effectively leads to broadening of the latter, and may even lead to its splitting.

Note, in conclusion, that the method of calculating the intensity of scattered radiation outlined here is applicable to the description of the interaction of any type of radiation with matter. Thus, analogous calculations may be performed for Mössbauer spectroscopy on electron and x-ray beams. The only requirement on the radiation in the present work is an exponential absorption law in the material.

**LITERATURE CITED**


**QUANTITATIVE ANALYSIS OF Al-Zn ALLOYS IN THE EARLY STAGE OF DECOMPOSITION**

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The method of low-angle x-ray scattering is used to perform a detailed analysis of the early stage of decomposition of Al-Zn alloys with 4.41 and 9.41 at. % Zn quenched at different homogenization temperatures. The parameters that characterize the post-quench state of the alloys are determined. It is found that a reduction in the quenching temperature is accompanied by a reduction in the size of the Guinier-Preston (GP) zones and their content of the dissolved element. Here, the density of the zones also decreases. An attempt is made to establish a connection between the parameters of the GP zones and the regions containing closely-spaced lamina formed in the alloys at the homogenization temperature.

The method of high-temperature x-ray spectrometry was used in [1] to establish that the degree of nonuniformity of the single-phase state of Al-Zn alloys depends on the homogenization temperature \( T_h \). Specifically, a decrease in \( T_h \) is accompanied by an increase in the nonuniformity of one-phase Al-Zn alloys. This empirical finding indicates that the value of \( T_h \) at which quenching is done should have an effect on the decomposition of Al-Zn alloys. In fact, we observed in [2] that these alloys have critical temperatures \( T_{cr} \) which divide their one-phase region into two intervals: if the quenching temperature \( T_q \geq T_{cr} \), the Al-Zn alloys decompose by the formation of spherical GP zones. If \( T_q < T_{cr} \), then they decompose by the formation of lamellar \( \beta \)-phase precipitates. This empirical fact serves only as qualitative evidence of the effect of \( T_h \) on the decomposition of Al-Zn alloys. The quantitative side of this question remains unanswered. It is necessary to explain how \( T_h \) affects the parameters that characterize the post-quench state of the alloys (the size of the GP zones, the number of these zones per unit volume of the alloy, the concentration of the dissolved element in the zones, etc.).

The goal of the present study is to make a detailed quantitative investigation of the state of Al-Zn alloys after quenching from different $T_h$.

The objects of our study were Al-Zn alloys with 4.41 and 9.41 at. % Zn made from aluminum 99.99 at. % pure and zinc 99.9 at. % pure in evacuated quartz ampuls. The elements were carefully mixed while in the liquid state. The specimens prepared for study were foils 0.045 mm thick. The foils were obtained by rolling in rolls and subsequent electrolytic etching.

The specimens were heat-treated in the following manner: homogenization at the pre-quench temperature for 4 h; sudden quenching in cold water ($+10^\circ$C) and holding at this temperature for 5 min. The temperature during homogenization was monitored by a high-precision VRT-3 temperature regulator to within $\pm 1.5^\circ$C.

The post-quench state of the Al-Zn alloys was studied by the method of low-angle scattering (LAS) of x-rays with the use of monochromatized CuK$_\alpha$-radiation in a vacuum chamber with a Kraut collimator [3]. The primary radiation was monochromatized with a rapid glass monochromator [4].

The low-angle-scattered radiation was recorded with an SRS-4 scintillation counter operated with a pulse-amplitude discriminator. The intensity of the LAS was determined from an angle equal to $8'$ from the center of the primary beam. The intensity of LAS by the specimen was measured three times for each angle of rotation of the counter. The number of pulses collected during each measurement ensured that intensity was determined with an error no greater than about 3%. The absolute intensity of LAS was determined by the method proposed in [5]. Here, the intensity of the primary beam was determined by the method of absorbing filters [6].

The dimensions of the GP zones in the Al-Zn alloys were determined from the Guinier formula [7]:

$$I = N n^2 \exp \left[ - \frac{4\pi^2 R_1^2}{5 \lambda^2} \right],$$

where $I$ is the intensity of LAS in electronic units; $N$ is the number of GP zones in 1 cm$^3$ of the alloy; $n$ is the number of excess electrons in a zone; $R_1$ is the radius of the GP zone; $\lambda$ is the wavelength of the radiation; $\epsilon$ is the scattering angle.

Our experimental results were obtained in the study of the distribution of LAS intensity for an Al-Zn alloy with 4.41 at. % Zn quenched at different $T_h$ (see Fig. 1, where $T_0 = 560^\circ$C for 1, 500$^\circ$C for 2, and 400$^\circ$C for 3). The experiment revealed the following: a) an