This paper gives results of the x-ray analysis of a eutectic Ag–Ge melt at temperatures of 655, 670, 685, 710, and 750°C. The intensity curves in copper radiation are obtained and the radial distribution curves of the atoms are calculated. It is established that a eutectic Ag–Ge melt in the range of temperatures under investigation may be described by a model of the statistical distribution of the atoms.

According to the information available to us, so far no x-ray analysis studies have been carried out on alloys of the Ag–Ge system. Nevertheless, this is an interesting system since for 28 at. % Ge, it forms a eutectic with negative energy of mixing.

The Ag–Ge eutectic, in accordance with the classification [1] belongs to the type of simple (α + Ge), i.e., the eutectic is formed by pure Ge and a solid solution of germanium in silver. It was shown in [2] that the maximum solubility of germanium in silver equals 7.16 at. % at the eutectic melting point 650°C. We note that Hume-Rothery and his colleagues [3] showed that under long-term annealing alloys with a germanium content of up to 20 at. % have the single-phase structure of an α-solid solution. However, Vol [4] expressed the opinion that the results obtained in [2] must be considered more plausible.

This present communication gives results of the x-ray investigation of an Ag–Ge alloy of eutectic concentration at temperatures of 655, 670, 685, 710, and 750°C. The x-ray photography was carried out

![Fig. 1](image1)

**Fig. 1.** Intensity curves of an Ag–Ge eutectic melt: 1) 655°C; 2) 670°C; 3) 685°C; 4) 710°C; 5) 750°C.

![Fig. 2](image2)

**Fig. 2.** Graph of the temperature dependence of the height of the first (1) and second (2) peaks of the intensity.
TABLE 1

<table>
<thead>
<tr>
<th>T°C</th>
<th>Position of the maxima on the intensity curves, Å⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>655</td>
<td>2.70 4.7 6.7–6.8</td>
</tr>
<tr>
<td>670</td>
<td>2.70 4.7 6.6–6.8</td>
</tr>
<tr>
<td>685</td>
<td>2.70 4.7 6.8–7.1</td>
</tr>
<tr>
<td>710</td>
<td>2.70 4.8 6.8–7.1</td>
</tr>
<tr>
<td>750</td>
<td>2.70 4.8 6.8–7.2</td>
</tr>
</tbody>
</table>

The x radiation scattered by the liquid was registered using a scintillation counter based on an NaI(Tl) single crystal, and an FEU-35 photomultiplier.

The angles were read off using a vernier with accuracy ±6'. Helium was used as the protective atmosphere.

The intensity curves of the coherent scatter of the x-rays were obtained by correcting the experimental curves for absorption, polarization, and incoherent scatter, and were given in electronic units. Here

\[ I_{\text{coh}}^{\text{c.e.u.}}(s) = \kappa I_{\text{corr}}^{\text{c.e.u.}}(s) - I_{\text{incoh}}^{\text{c.e.u.}}(s), \]  

where

\[ I_{\text{incoh}}^{\text{c.e.u.}}(s) = \sum_{i=1}^{\infty} \frac{c_i I_{\text{fi}}(s)}{s^2 ds}, \]

\[ \kappa = \frac{\sum_{i=1}^{\infty} I_{\text{corr}}^{\text{c.e.u.}}(s)}{\sum_{i=1}^{\infty} c_i I_{\text{fi}}(s)}, \]

\[ I_{\text{corr}}^{\text{c.e.u.}}(s) = \frac{I_{\text{frac}}(s)}{P, A}. \]

Here \( P \) and \( A \) are the polarization and absorption factors

\[ P = \frac{1 + \cos^2 2\alpha \cos^2 \Theta}{1 + \cos^2 \Theta}, \]

\[ A = \frac{\sin(2\Theta - \alpha)}{\sin \alpha + \sin(2\Theta - \alpha)}; \]

\( \alpha \) is the glancing angle of the primary ray. The values of the atomic scatter factors are borrowed from [6] and corrected for anomalous dispersion using the expression

\[ f(s) = f_0(s) + \Delta f' + i\Delta f'', \]

where \( f_0(s) \) is the atomic scatter factor for radiation with frequency much higher than the absorption frequency; \( \Delta f' \) and \( \Delta f'' \) are components of the anomalous dispersion. In accordance with [7], in the case of CuKα radiation, \( \Delta f' \) and \( \Delta f'' \) equal 0.5, 1.3, and 4.7, 1.1 respectively for Ag and Ge. Moreover, we took into account the temperature dependence of the atomic factor, i.e., \( f(s) = f_0 e^{-2M} \).

The curves obtained for the total intensity of the x-rays scattered by a liquid Ag–Ge alloy of eutectic composition are given in Fig. 1. Three maxima are clearly distinguished on the curves; their angular positions are given in Table 1.

As the temperature increases, smearing of the maxima and a decrease in their height becomes apparent (Fig. 2). The height of the second maximum begins to increase somewhat from 695°C onwards. We note too that the characteristic lateral maximum on the right slope of the principal peak which is characteristic for liquid germanium is absent from the Ag–Ge intensity curves.

The total intensity of coherent x-ray scatter depends on the mutual distribution of the different kinds of atoms, i.e., \( \rho_{AA}, \rho_{BB}, \) and \( \rho_{AB} \). From this it follows that \( I_{\text{coh}}^{\text{c.e.u.}}(s) \) may be expressed in terms of partial scatter functions \( I_{AA}, I_{BB}, \) and \( I_{AB} \) [8]:

\[ I_{\text{coh}}^{\text{c.e.u.}}(s) = \sum_{i=1}^{\infty} c_i I_{\text{fi}}^{\text{c.e.u.}}(s) = \rho_{AA} I_{AA}(s) + \rho_{BB} I_{BB}(s) + \rho_{AB} I_{AB}(s), \]

where

\[ I_{ij}(s) = 1 + \int_0^\infty r G_{ij}(r) \frac{\sin sr}{sr} dr, \]