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Synthesis and X-Ray Phase Analysis of $Cd_3Sb_2S_8$ Obtained from Schlippe's Salt

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Açar sözlər: *şlippe duzu, rentgen faza, tioduz, kristal quruluş*

Schlippe's salt was used as the source of antimony and sulfur during the synthesis of the $Cd_3Sb_2S_8$ compound. The dissociation of Schlippe's salt in an aqueous medium generated thioantimonate ions, which acted as active species in the subsequent reactions (Babanly, 2024). Cadmium ions introduced into the solution interacted with the thioantimonate complexes, creating favorable conditions for the formation of the Cd–Sb–S system. The temperature and pH of the reaction medium played a significant role in regulating the nucleation and crystal growth processes (Aliyeva, 2026).

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The precipitated product was subjected to successive washing and drying steps to remove residual ionic impurities. During the subsequent heat treatment, the amorphous particles underwent crystallization, which accelerated the formation of the $Cd_3Sb_2S_8$ phase. The results of X-ray diffraction analysis confirmed the successful formation of the $Cd_3Sb_2S_8$ compound in the synthesized sample and indicated its high degree of crystallinity.To determine the crystal structure, phase composition, and identify the compounds formed during the synthesis process, X-ray phase analysis (Mamaedova, 2020) was performed (Figure 1).

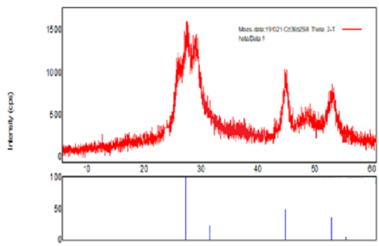

Figure 1

X-ray phase analysis of the compound $Cd_3Sb_2S_8$

The XRD diffractogram presented in the figure was used to characterize the crystal structure of the $Cd_3Sb_2S_8$ sample. The intense diffraction peaks observed in the spectrum indicate the crystalline nature of the material. The main peak located in the 2θ range of approximately 27–29° confirms the presence of the dominant crystallographic planes within the sample (Mamedova, 2016). The high intensity of the peaks is one of the important indicators of the successful formation of the $Cd_3Sb_2S_8$ phase. Reflections observed around 45° demonstrate the well-ordered arrangement of the crystal structure. The peaks recorded in the 53–55° region suggest that the material is predominantly single-phase rather than multiphase. The moderate broadening of the diffraction peaks may be associated with the presence of nanometer-sized crystallites. The relatively high background intensity indicates the possible existence of a small amount of amorphous components in the sample. The diffraction results confirm the formation of the crystal structure of the $Cd_3Sb_2S_8$ compound. The agreement of the peak positions with standard reference data demonstrates that the synthesis process was successfully carried out. The absence of strong reflections corresponding to secondary or undesirable phases indicates the high purity of the obtained product.

Analysis of the diffractogram reveals the polycrystalline nature of the material. The formation of the crystal structure can be explained by the stable incorporation of Cd and Sb ions within the sulfide matrix. The XRD results provide strong evidence for the successful synthesis and structural stability of $Cd_3Sb_2S_8$ nanocrystals. Overall, the obtained diffraction pattern indicates that the $Cd_3Sb_2S_8$ sample possesses a well-crystallized structure and represents a promising material for future optical and electronic applications.

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