

Uncooled X-Ray Detectors Based on $\text{TlGa}_{1-x}\text{Co}_x\text{S}_2$ Single Crystals

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Single crystals of the TlGaS_2 compound belong to the class of wide-band-gap semiconductors with a layered structure and a high sensitivity to electromagnetic radiation in the visible spectral range. The purpose of this work was to investigate how the cobalt doping of TlGaS_2 single crystals affects their x-ray dosimeter characteristics. Samples of TlGaS_2 single crystals were prepared in the form of plates in such a way that the dc electric field applied to the sample would be directed across the natural layers and the x-rays would be incident along the C-axis. Ag paste was used as a contact material. The thickness of the crystals was 100–140 mkm. All measurements were carried out at $T = 300$ K. The Roentgen sensitivity coefficient of the crystals under investigation was calculated by the formula: $K = DI_r / (U \times E)$, where DI_r is Roentgen current; U is the applied voltage and E is a dose rate. Roentgen sensitivity coefficients of $\text{TlGa}_{1-x}\text{Co}_x\text{S}_2$ single crystals are given in Table.

Roentgen sensitivity coefficients of $\text{TlGa}_{1-x}\text{Co}_x\text{S}_2$ single crystals at $T = 300$ K

Dose rate $E = 2.73$ R/min; accelerating voltage $V_a = 25$ keV

Composition of the crystal	$K, 10^{-12} \text{ A} \times \text{min} / (\text{V} \times \text{R})$
TlGaS_2	1.35
$\text{TlGa}_{0.995}\text{Co}_{0.005}\text{S}_2$	23.1
$\text{TlGa}_{0.99}\text{Co}_{0.01}\text{S}_2$	51.9

As can be seen from this Table the x-ray sensitivity of $\text{TlGa}_{1-x}\text{Co}_x\text{S}_2$ increases with increase of cobalt content in crystals. The results obtained have demonstrated that TlGaS_2 single crystals are characterized by a high x-ray sensitivity and can be used in the design of uncooled (operable at room temperature) x-ray detectors.