Properties of lead sulfide films deposited from $[Pb(CH_3COO)_2(N_2H_4CS)_2]$ complex compound

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Lead sulfide is one of main materials used as detectors of infrared radiation in semiconductor optoelectronics. The infrared sensors and transducers used in night vision instruments and thermal systems for missile targeting are created on its basis. So, developing technologies for creating lead sulfide films with specific optical and photoelectric properties and crystal structures is of great interest. The pyrolysis of aerosols of thiourea coordination compounds (TCC) is one of the simplest and cheapest ways of accomplishing this, and it allows us to obtain high quality samples with specific properties [1, 2]. The aim of this work was to study the optical properties and structure of lead sulfide films deposited from $[Pb(CH_3COO)_2(N_2H_4CS)_2]$ complex compound.

Lead sulfide films were prepared via pyrolysis of an aerosol from water solutions of thiourea coordination compounds $[Pb\ (CH_3COO)_2(N_2H_4CS)_2]$ formed during interaction between lead acetate (C_{Me} = 0.1 mol/l) and thiourea (C_{thio} = 0.1–0.5 mol/l). For complexation we used $Pb(CH_3COO)_2 \cdot 4H_2O$ salt of chemically pure grade and thiourea N_2H_4CS of extra pure (9–5) grade. Melt quartz plates 0.3 μm thick were used as substrates. The substrate temperature during pyrolysis was ranged from 250 to 450°C. The time of film deposition varied from 1.5 to 2.5 min. The films had a high degree of continuity and shiny surface. Studies of surface properties via atomic force microscopy (AFM) showed that the size of the conglomerates surface varies from 110 to 120 nm depending on the deposition temperature. XRD analysis showed that the films were structured lead sulfide. The crystallite size determined from the broadening of a specific diffraction peak (200) was changing with the deposition temperature increase at close to a linear law between 11 and 52 nm. Intrinsic absorption spectrum as measured by Fourier spectrometer in the wavelength range of 0.7–1.5 μm showed that the main mechanism of absorption in this area is indirect allowed transitions, the energy of which varies little depending on the technological parameters of the production of films (E_{gid} = 0,47 ± 0,2 eV).

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References

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