

Oxidation of tin telluride films in an oxygen atmosphere

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Tin telluride (SnTe) oxide films have wide applications in various industries such as electronics, optics and thermoelectricity due to their unique physical and chemical properties. One of the fundamental qualities of studying these materials is their behavior in an oxygen atmosphere, which describes the stability and duration of operation of devices based on them.

This study examines the main aspects of the oxidation processes of tin telluride films in an oxygen atmosphere. The main attention is paid to changes in the structure of films, their morphology and electrical characteristics [1]. Different oxidation conditions such as temperature, oxygen concentration and exposure time are analyzed to provide detailed insights into the behavior of SnTe in an oxidizing environment.

Of certain scientific and practical interest are works devoted to the study of changes in the chemical, phase composition and surface morphology of SnTe films during isochronous and isothermal annealing in an air atmosphere [2]. In this work, the oxidation of epitaxial SnTe films deposited from the gas phase on cleaved barium fluoride crystals (111) was studied using Auger electron spectroscopy, nuclear gamma resonance, X-ray diffraction and metallography [3]. SnTe films were subjected to isochronous (for 1 hour) annealing in air at $T = 300-850$ K (Fig. 1).

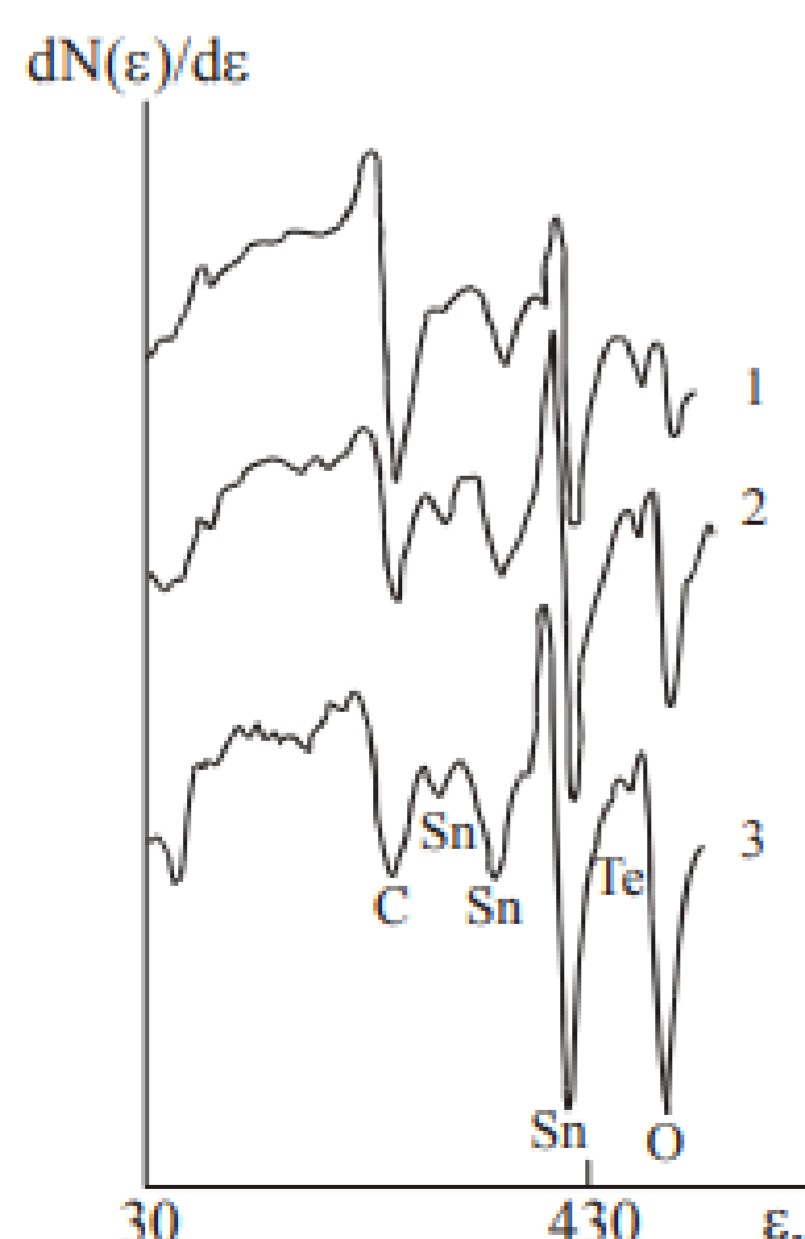


Fig. 1. Auger spectra of the initial and isochorically annealed in air at 470 K(2), 640 K(3), 840 X(4) epitaxial SnTe films.

A common pattern for all epitaxial films studied is that their initial surface is always saturated with oxygen. A further increase in the film annealing temperature causes an increase in the intensity of oxygen peaks in the Auger spectra [3]. This is direct evidence of an increase in the amount of oxygen on the surface of the films. In this case, the intensity of tin in the Auger spectra of SnTe remains almost unchanged. Consequently, tin is effectively oxidized at the initial stages of annealing, forming a stable oxide on the surface that prevents further progress of the process (Fig. 2).

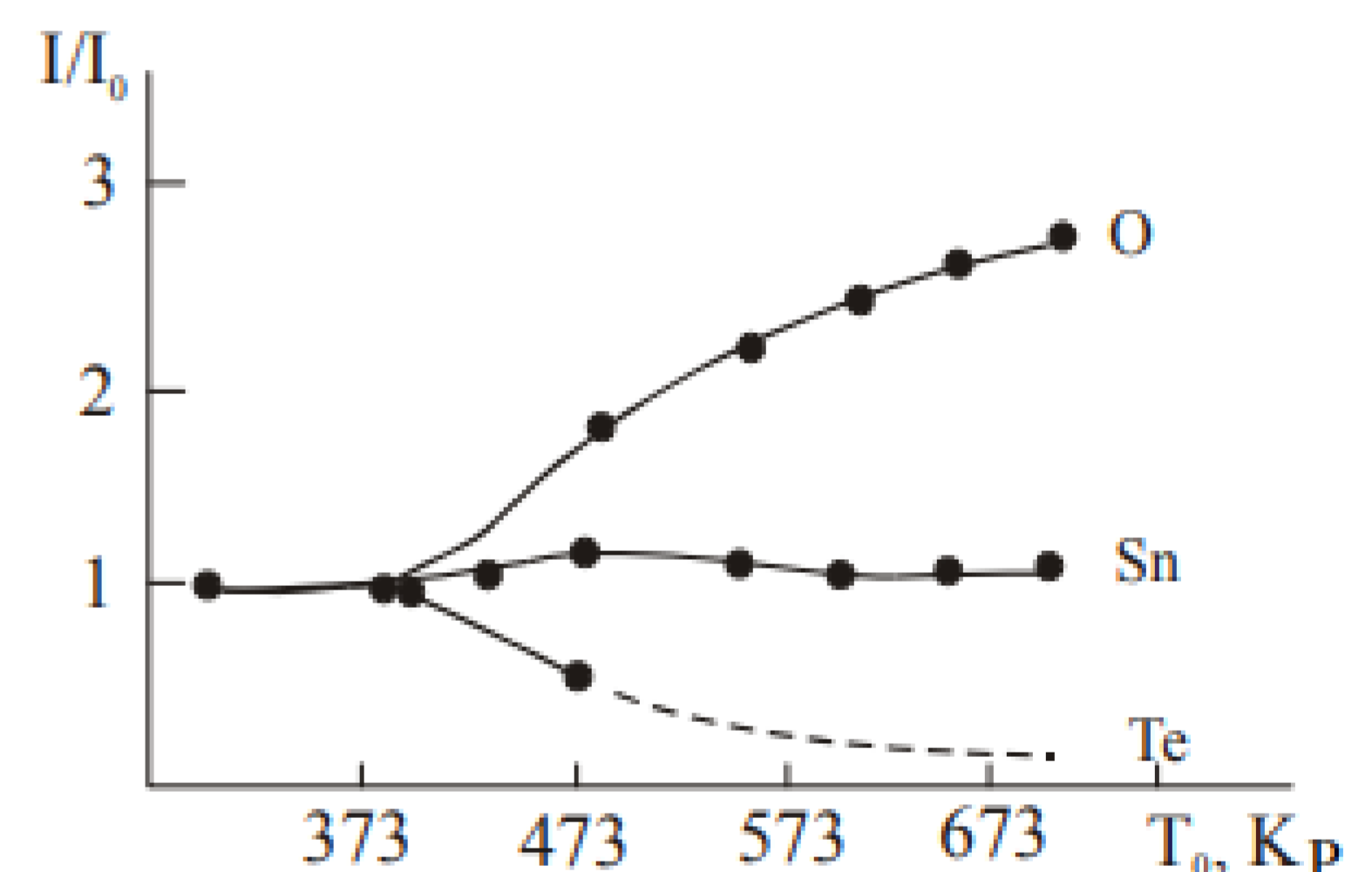


Fig. 2. Dependence of the relative values of the amplitudes of the Auger spectra of Sn, Te and O on the temperature of isochoric annealing in an oxygen atmosphere of SnTe films.

Oxidation processes are key to understanding changes in the properties of SnTe films under environmental influences. Oxidation can lead to the formation of oxide layers that affect the electrical conductivity, optical properties and stability of the material. Therefore, the study of oxidation mechanisms and their influence on the structure and properties of SnTe films is an urgent task of modern materials science.

[1] V.V. Prokopov, Materials of electronic technology: textbook, Ivano-Frankivsk: Precarpathian National University named after V. Stefanika, 2009, pp. 288.

[2] T.M. Mazur, M.M. Slyotov, V.V. Prokopiv, O.M. Slyotov, M.P. Mazur, *Molecular Crystals and Liquid Crystals*, 2023, vol 752, №1, pp. 95–102.

[3] M.O. Galushchak, L.I. Mezhylovsjka, M.V. Pyts, V.V. Boryk, G.D. Mateik, *Physics and chemistry of solid state*, 2001, vol 2, №2, pp.213–215.