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ABSTRACT REPORTS

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The Model of a Mechanism of Oxygen Adsorption and Transformation on an Oxide Surface

As the molecule O_2 approaches the solid surface L, the molecule bond weakens [1]. The molecule-bond energy decreases by the value equal to the energy of the bond between the molecule and the surface. The adsorption bond can strengthen if the molecule-solid complex ($L-O_2$) drops to a lower energy level. The corresponding energy q is given off as the part of the heat of adsorption.

A conduction electron drops with radiation to the level formed by the chemisorption,

$$O_2^{\bullet}L + e \rightarrow O_2^{\bullet}eL + h\nu.$$

Then the electrical resistance of an n-type oxide increases [2].

The energy Q released on chemisorption (the heat of adsorption) can be presented as

$$Q = q + h\nu.$$

If the energy $h\nu$ emitted on the transition from the "weak" form of chemisorption to the "strong" one coincides with the molecule-bond energy, the molecule absorbs the energy $h\nu$ resonantly and then dissociates,

$$O_2^{\bullet}eL + h\nu \rightarrow OeL + O.$$

The atom produced by the dissociation couples with the "strongly" chemisorbed oxygen molecule and an ozone is formed,

$$O_2^{\bullet}eL + O \rightarrow O_3 + eL.$$

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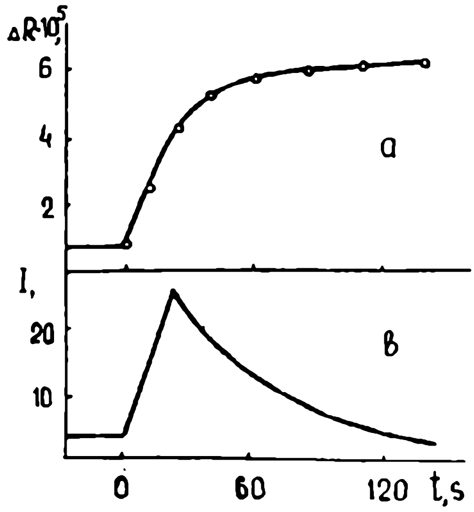

Fig. 1. The time dependences of a) resistivity and b) luminescence intensity for oxide at 473 K with O_2 pump from 10^{-6} to 10^{-2} Pa

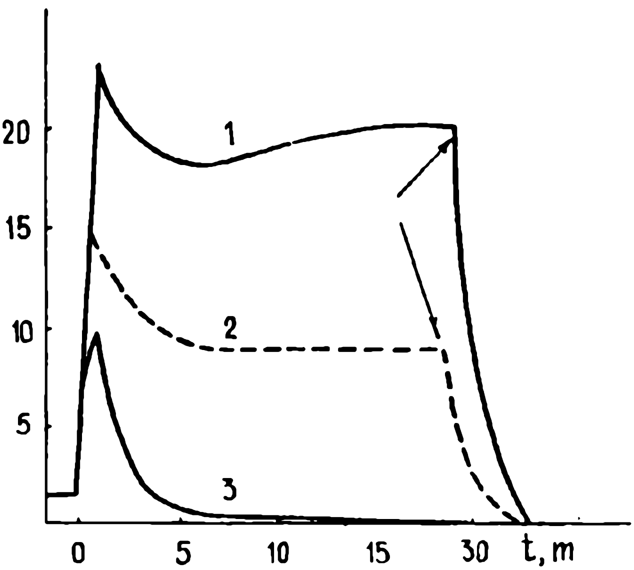

Fig. 2. The kinetics of luminescence intensity for oxide at different values of temperature and pump of O_2: 1) 550 K, 10^{-6}–10 Pa; 2) 550 K, 10^{-6}–10^{-1} Pa; 3) 400 K, 10^{-6}–10^{-1} Pa

The energy released on the ozone formation causes its desorption from the center in which the radiation accompanies the adsorption. The OeL reacts with an oxygen of the gaseous phase and also forms an ozone

$$OeL + O_2 \rightarrow O_3 + eL$$

which is being desorbed from the center in which the dissociative chemisorption occurs.

Thus the luminescence and the transformation of molecular oxygen into ozone is continuous in time (unless a critical concentration of gaseous O_2 is attained), which is observed by experiment [3] (Fig. 2). The presence of ozone is detected by the chemical reaction of precipitation of iodine from iodide potassium.

REFERENCES

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[3] Ivankiv L. I., Olejnyk R. T., Pelech R. P., *Izv. AN SSSR*, ser. fiz. 52 (1988).