Variations in resistivity $R$ and work function $\phi$ of thin Tm and Dy films due to $H_2$ adsorption on their surface at 77 K have been studied. It is suggested that on most surfaces hydrogen is strongly adsorbed as $H^-\delta$, and only below 10% monolayer is its weakly adsorbed form $H^+_2$. The observed decrease of $\phi$ is attributed to $H^-\delta$ penetrating into lattice vacancies and surface cavities.

Despite the ever increasing number of studies dealing with the character of metal-hydrogen interactions, this problem does not lose its urgency, particularly in relation to rare-earth metals (REM), which are relatively poorly examined but are of great scientific and technical interest. To solve this problem, it is recommended to apply such relatively simple and well-known methods as variations in resistivity $R$ and work function $\phi$. 

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function \( f \) taking place in \( H_2 \) adsorption on films deposited in ultrahigh vacuum. These methods have been extensively used to study \( H_2 \) adsorption on films of transition metals [1-3, etc.]. But the literature data for REM are limited in number [4, 5, 6]. The author of [4] reports data for \( H_2 \) adsorption on Sc films at 77 and 293 K. Resistivity at 77 K rises and then it is saturated, which, according to the author's view, indicates the presence of two hydrogen forms: strongly bound atomic \( H^- \) and weakly bound molecular \( H_2^+ \). The complex character of \( R \) curve at 293 K indicates the possibility of \( H_2 \) dissolution in Sc. The authors of Ref. [5] used a diode method of recording the initial regions of voltage-current curves to study \( \Delta f \) in \( H_2 \) adsorption on Yb and Gd at 313 K and on Gd at 77 K.

We now present the results of application of the above methods to study \( H_2 \) chemisorption on Dy and Tm films at 77 K.

EXPERIMENTAL

Experiments were carried out in a glass ultravacuum installation [7], with a stable \( 10^{-7} \) Pa vacuum in the operational volume. The design of the reactor where our films were deposited (Fig. 1) permitted to study variations in both \( R \) and \( f \) using the diode method as well as the kinetics of model reactions of isotope exchange and ortho-para conversion in \( H_2 \). The reactor was a glass vessel (d=30 mm) with the upper part made as a Dewar flask with two pairs of Mo wires soldered into its bottom. Two tungsten spirals (d=0.3 mm) were spot-welded (1, 2) to the Mo inputs. 10-20 mg metal samples were placed into spiral (1) and evaporated. Metal film was condensed on the internal surface of the reactor and covered Pt wires (d=0.2 mm) (3) half-pressed into glass and welded to the Mo wires (4) connected with a standard R-4833 bridge to measure the film \( R \). Spiral (2) was used as a cathode emitter of electrons to measure \( f \) and its variations in \( H_2 \) adsorption using the diode method. In this case the film was the anode and connected with the diode circuit using Pt wires (3).