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EFFECT OF STRAIN ON THERMOSTIMULATED EXOELECTRON EMISSION FROM NICKEL DURING PHASE TRANSITION

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It is found that the positions of exoemission peaks in the curve of photostimulated electron emission, $\frac{N}{t} = f(T)$, of a nickel sample covered with oxide, corresponding to the Néel and Curie points, shifts towards lower temperatures when the initial dilatation of the sample is increased. It is also ascertained that light stimulation affects the position of these peaks.

In papers [1, 2] Sujak, Biernacki and Górecki reported the appearance od maxima in the curve of photo-thermostimulated exoelectron emission recorded during the phase transition of nickel and the nickel oxide NiO coating on the sample surface. Exoelectrons were detected by means of a diffusion point counter with quenching ethyl alcohol vapour above the free surface of the liquid [3]. It was presumed that simultaneous illumination of the sample with UV light is a necessary condition for the appearance of emission intensity maxima in the vicinity of the Curie and Néel points. It was shown later on, however, that the Curie point of nickel is revealed by an emission intensity peak in the curve of thermostimulated electron emission also without any illumination of the sample surface with UV radiation [4].

In this paper we present some comments on the effect of the deformation of a nickel sample on the position of emission intensity peaks in the $\frac{N}{t} = f(T)$ curves.

The exoelectron detector was an air point counter with saturated quenching vapour above the free surface of the liquid coupled with a classical recording system. The counter's

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cathode of diameter 1.3 cm had a potential positive relative to the sample (+250 V). The anode voltage was between 2590 and 2620 V, depending on the atmospheric pressure at the time of measurement. The counter operated at a temperature of 314.5 K. The samples of nickel sheet used in the measurements were first washed in acetone, rinsed in distilled water and ethyl alcohol and then dried in a stream of air. Thermostimulated exoelectron emission measurements were carried out on raw nickel samples unexposed to any initial treatment and on other samples previously strained and left in the strained state in the deformation device during the exoelectron emission measurements were carried on. A special temperature programming unit allowed the temperature of the emitting sample to be changed linearly at a rate of $v = 1.41$ deg/sec. Measurements of the $\frac{N}{t} = f(T)$ dependence were carried out in the dark or with the emitting surface illuminated with UV light, the source of which was a Q 400 quartz lamp.

Figure 1 shows the measured temperature-dependence of exoelectron emission from pure nickel samples illuminated with UV light. The curves reveal two peaks during the heating cycle, B_{light} and A_{light}. The position of peak B is at about 400 K and corresponds to the transition of nickel oxide NiO from the antiferromagnetic state to the paramagnetic

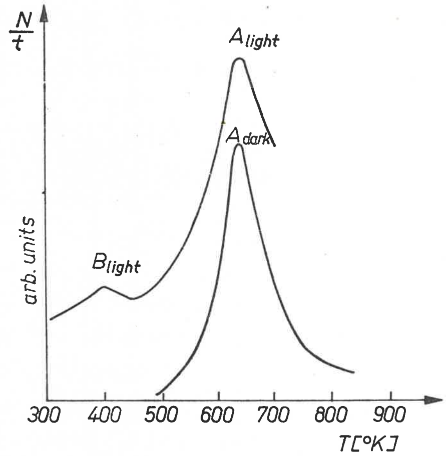

Fig. 1. Temperature-dependence of intensity of exoelectron emission, $\frac{N}{t} = f(T)$, for pure nickel samples illuminated with UV light (A_{light} and B_{light}) and in the dark (A_{dark}). Peak positions correspond to Néel point for NiO and Curie point for nickel

state. The other peak, A, appears at about 630 K and corresponds to the Curie point of pure nickel.

In the case of measurements carried out in the dark, there is seen only one maximum at a temperature of about 630 K, A_{dark}. This curve is also plotted in Fig. 1.

Identical measurements were also performed with nickel samples which had been initially dilated uniaxially. The relative dilatations were 6.4%, 8.75%, 12.1%, 16.3%

and 21.5%. It was found that on the $\frac{N}{t} = f(T)$ curve taken in the dark there is only one peak at about 630 K corresponding to the Curie point of nickel, in agreement with earlier findings [4]. This maximum, A_{dark}, keeps shifting towards the lower temperatures as the strain increases, as is shown in Fig. 2.

In the case when there is emission stimulated by light, the $\frac{N}{t} = f(T)$ curves have two peaks at about 400 K and 630 K (B_{light} and A_{light}) which with increasing strain (from

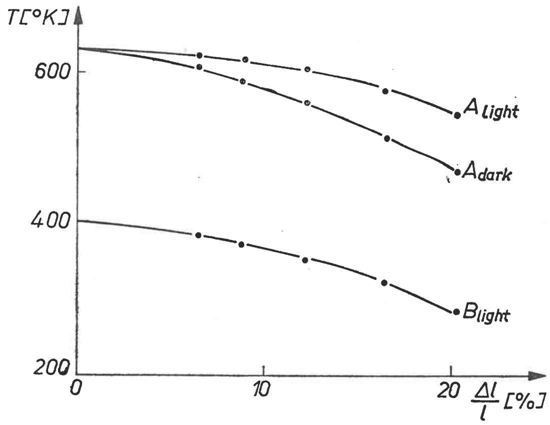

Fig. 2. Positions of maxima in $\frac{N}{t} = f(T)$ curve *versus* strain for nickel samples initially deformed plastically. Measurements were made in the dark (A_{dark}) and with UV illumination (A_{light} and B_{light})

6.4% to 21.5%) become shifted towards the lower temperature from 400 to 280 K and from 630 to 550 K, respectively. This is also illustrated in Fig. 2.

The question of the extent to which the large values of the displacement of the peak positions on the $\frac{N}{t} = f(T)$ curves in plastically deformed nickel correspond to shifts of the Curie and Néel points [5–8] remains to be answered by further research.

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