Electrical and photoelectrical properties of MoO_x/n-CdTe heterojunctions

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Molybdenum oxide (MoO_x) and cadmium telluride (CdTe) are prospective compounds for the application in different photoelectrical devices due to their electrical and optical properties[1].

This work is focused on the investigation of the electrical and photoelectrical properties in the heterojunctions, fabricated by the deposition of MoO_x thin film by the DC reactive magnetron sputtering technique onto CdTe single crystal substrates.

The deposition of the MoO_x thin films was carried out onto the freshly cleaved surface of CdTe single crystal (with dimensions 3×5×1 mm) in a universal vacuum setup Laybold – Heraeus L560 by means of the DC reactive magnetron sputtering of the pure molybdenum in a mixture of argon and oxygen gases.

The CdTe substrates were mounted over the magnetron with the further rotation in order to provide the uniform thickness of the films. Before the start of the deposition process the vacuum chamber was pumped down to the pressure of the residual gases 5×10^{-5} mbar.

The formation of the gas mixture from argon and oxygen in the necessary ratio was carried out from two different sources during the deposition process. The partial pressures of argon and nitrogen were 3.4×10^{-3} mbar and 2.4×10^{-4} mbar, respectively. The magnetron power was 120 W. The substrate temperature was 473 K during the deposition process. The duration of the deposition process was 10 min.

Current-voltage characteristics of the MoO_x/n-CdTe heterojunctions were measured by means of a measuring complex SOLARTRON SI 1286, SI 1255.

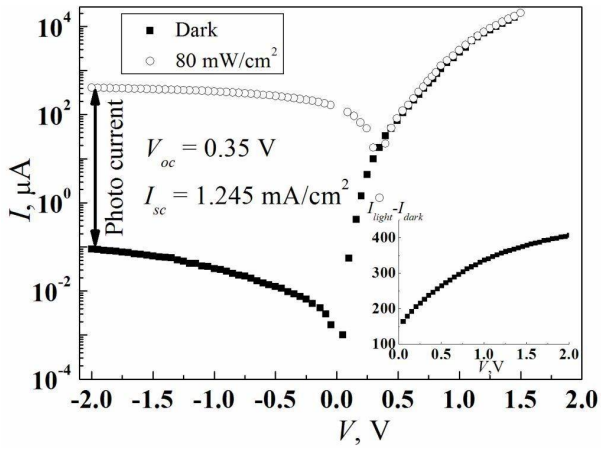

Fig. 1 Dark and light I-V curves of the MoO_x/n-CdTe heterojunction in the semilogarithmical scale.

Fig. 1 shows the dark and light I-V characteristics of the MoO_x/n-CdTe heterojunction. It is seen from the figure that the reverse current I_{light} under white light illumination of 80 mW/cm^2 increases in comparison to the its value in the dark I_{dark}. The heterojunction generates the open-circuit voltage V_{oc} = 0.35 V and the short circuit current I_{sc} = 1.245 mA/cm^2. It should be noted the voltage dependence of the photocurrent (I_{light} - I_{dark}) (the inset in fig. 1), that is caused by the increase of the efficiency of the separation of the photogenerated charge carriers due to the widening of the space charge region with the increase of the reverse bias [2]. However, further analysis is needed for the determination of the dominating recombination losses of the photogenerated charge carriers in the MoO_x/n-CdTe heterojunctions.

[1] K. L. Chopra and S. R. Das, *Thin Film Solar Cells* (Plenum, New York, 1983).
[2] M. N. Solovan, V. V. Brus, P. D. Maryanchuk. *Semiconductors,* Vol. **48**, No. 11, pp. 1504–1506 (2014).