EFFECT OF NANOSTRUCTURING TO RESPONSE KINETICS OF TELLURIUM THIN FILMS BY NITROGEN DIOXIDE SENSING

Dumitru Tsiulyanu[a], Marina Ciobanu, Olga Mocreac
[a] *Department of Physics, Technical University, bul. Dacia 41, MD-2060 Chisinau, Moldova,* *tsiudima@gmail.com*

The work is conducted to clarify the effect of structural dimensionality of tellurium thin films on gas (NO_2) sensing at room temperature. Nanostructuring of Te films has been realized via three methods (Fig.1): nanocrystalization (a), growing of amorphous Te films with nanoscaled thicknesses onto uniform Si/SiO_2 wafers (b) or onto priory nanostructured (Al_2O_3) substrates (c). Pure Te thin films were crown via thermal vacuum evaporation but their surface morphology, microstructure and thickness were investigated using SEM, XRD and AFM respectively. The films were supplied with either Au or Pt electrodes, thus the resistive gas sensing elements have been built. Their gas sensing properties have been investigated using the experimental set-up described in [1], taking into consideration the concentration induced damping of gas sensitivity in ultrathin layers found out in our previous work [2].

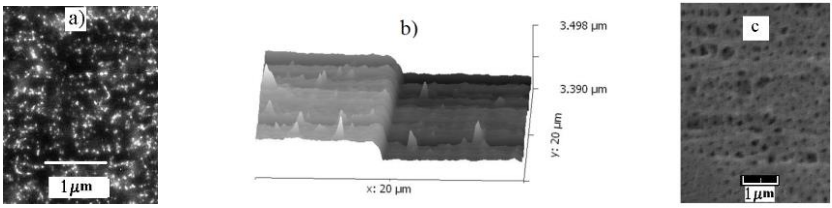

Fig.1. (a) SEM of nanocristalline Te film; (b) AFM of an ultrathin amorphous Te film; (c) SEM of an amorphous Te film grown onto preliminary nanostructured substrate.

It was shown that the response kinetics of tellurium thin films is strongly influenced by structural dimensionality, which is controlled by grown rate. The increasing of growing rate results in transformation of nanocrystalline structure of the film into an amorphous one. Amorphous films, being nanoscaled either by diminishing the films thickness or by their growing onto preliminary nanostructured substrates, show considerably short response time to low concentrations of nitrogen dioxide. The recovery time of initial state of these films, also become shorter that allows their application in development of room temperature operating gas sensitive devices for environment pollution monitoring.

[1] D. Tsiulyanu, M. Ciobanu, Glass Physics and Chemistry, **2019**, 45, pp. 53–59.
[2] D. Tsiulyanu, O. Mocreac, Sensors and Actuators , B, **2013**, 177, pp. 1128 – 1133.