ISSN 1822–7759

Book of Abstracts
of the 15-th International Conference-School

ADVANCED MATERIALS AND TECHNOLOGIES

27–31 August 2013, Palanga, Lithuania

TECHNOLOGIJA
KAUNAS • 2013

P43. Influence of Medical Electron Radiation and Annealing on Photoelectron Emission from Lead Sulphide Nanodots

Y. Dekhtyar[1], P. Kovalovs[1], D. Krumpane[1], R. Reisfeld[2], A. Resetnikova[1], M. Romanova[1], T. Saraidarov[2], I. Surkova[1]

[1]*Institute of Biomedical Engineering and Nanotechnology, Riga Technical University, Ezermalas 6k-248, Riga LV-1006, Latvia*
[2]*Hebrew University of Jerusalem, Institute of Chemistry, Israel*
E-mail: marina.romanova@inbox.lv

Task of radiation therapy is to destroy cancer cells by providing dose of ionizing radiation to the target tissue. Biological effects of ionizing radiation on more and more smaller structures of the cells are studied with the advancement of technology [1]. Field of nanodosimetry emerged in the beginning of 2000s with aim to measure absorbed dose in nanovolumes of the irradiated spot. Nowadays, simulation of the effects of ionizing radiation at the nanoscale is carried out using Monte Carlo method. However, there is a neèd to compare the results of simulations with the real measurements [2]. Therefore, there is need to develop a nanodosimeter – a device that can measure the dose at the nanoscale.

First step can be search for nano-sized materials which are susceptible to radiation in a dosimetric way. Lead sulphide (PbS) nanodots embedded in thin-film zirconia (ZrO_2) were studied. The ZrO_2:PbS films were irradiated with 6MeV medical electron radiation with doses 0–10 Gy. Dosimetric correlation between changes in photoelectron emission properties from the films and dose of electron radiation was searched for. Advantage of the method of photoelectron emission is that the signal is provided only from 10-100 nm deep surface layer of the studied material [3]. Derivatives of the photoemission spectra showed that certain electron emission centers exist in the ZrO_2:PbS films and there is a linear correlation between their concentration and dose of electron radiation.

In order to use the ZrO_2:PbS films repeatedly for dosimetric purposes, i.e. to irradiate them again, the films must be restored to their initial condition present before the irradiation. This was achieved by annealing them in vacuum (10^{-5} mmHg). It was shown that annealing the films at 150 °C during 30 min erased dose of electron radiation stored in them. It was also shown that this temperature did not destroy sensing properties of the ZrO_2:PbS films and they could capture dose of electron radiation again after annealing.

Keywords: *nanodosimetry, electron emission, lead sulphide nanodots.*

References:

1. K. Prise, G. Schettino, M. Folkard, K.D. Held., Lancet Oncology, 6(2005) 520–528.
2. H. Rabus, H. Nettelbeck., Radiation Measurements, 46(2011) 1522–1528.
3. H. Ibach. Electron Spectroscopy for Surface Analysis. Springer-verlag, New York, p.315, 1977.