



ABSTRACT BOOK

International research
and practice conference:

**NANOTECHNOLOGY
AND NANOMATERIALS
(NANO-2021)**

25-27 August 2021
Lviv, Ukraine

**INTERNATIONAL RESEARCH AND
PRACTICE CONFERENCE
“NANOTECHNOLOGY
AND NANOMATERIALS”**

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Abstract book

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The NANO-2021 Conference was organized by the Institute of Physics of NAS of Ukraine with the participation of the University of Tartu (Estonia), University of Turin (Italy) and Pierre and Marie Curie University – Paris 6 (France).

NANO-2021 was the ninth conference in the series of NANO-conferences initiated by the Institute of Physics of NAS of Ukraine in 2012 in the framework of FP7 Nanotwinning project. From year to year, they attract more attention and participants. In 2012, the first meeting was held in the format of International Summer School for young scientists «Nanotechnology: from fundamental research to innovations». The 2013 and 2014 conferences were organized in conjunction with the International Summer Schools for young scientists under the same title. In 2013, this event was attended by more than 300 scientists, in 2014-2016, 450 scientists took part and in 2017 it gathered above 650 participants. In 2018 conference was attended by more than 700 scientists from Ukraine, Poland, Italy, Estonia, France, Austria, Germany, Greece, Turkey, USA, Romania, Moldova, Czech Republic, Taiwan, Lithuania, Egypt, Iran, India, Algeria, Indonesia and other countries. In 2019 the Organizer Committee has received more than 800 application forms from about 25 countries of the world. NANO-2020 conference was held in combine format: online and off-line in Lviv. The event was attended offline by about 100 scientists, the first day of the broadcast on the Youtube channel has already been watched by more than 1,500 users from different countries of the world, and in total about 500 people have registered to participate in the conference.

The NANO-2021 conference brought together leading scientists and young researchers from many countries of the world. This year its topics were as follows: Nanobiotechnology for health-care; Nanochemistry and biotechnology; Nanocomposites and nanomaterials; Nanoobjects microscopy; Nanooptics and photonics; Nanoplasmonics and surface enhanced spectroscopy; Nanoscale physics; Nanostructured surfaces; Physico-chemical nanomaterials science.

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Optical and photoelectric properties of the CdTe: Cu layer

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Semiconductor thin-film solar cells with a multilayer structure are increasingly popular for obtaining renewable energy from solar radiation. The efficiency of solar cells can be significantly increased by controlled modification of the heterostructure [1].

Cadmium telluride with complex parameters such as an optimal band gap (1.45 eV), high absorption coefficient (10^5 cm^{-1}) and p-type of conductivity has proven to be an excellent material of the light absorber layer for photovoltaic applications. The high efficiency up to 21% of multilayer solar cells has been recorded based on CdTe / CdS [2]. CdTe is a direct-band semiconductor that can have both n-type and p-type conductivity, depending on the use of appropriate alloying impurities [3]. Therefore, controlled doping of these materials with p and n-type of carriers we can significantly improve the efficiency of PV-modules based on them.

The deposition technology is developed and the influence of copper impurity concentration on the optical properties of CdTe thin films is studied. To obtain thin films, the method of open evaporation in vacuum is used, which ensures the purity of the film due to the high vacuum [4]. In [1] show that the band gap decreases slightly with increasing concentration of the alloying impurity ($E_{g1} = 1.50 \text{ eV}$ (for 1% Cu), $E_{g2} = 1.48 \text{ eV}$ (for 2% Cu), $E_{g3} = 1.45 \text{ eV}$ (for 3% Cu)), however, a high absorption coefficient is observed in the film. Therefore, thin CdTe films doped with 3% Cu will be suitable for the p-layer of a highly efficient p-n solar cell, based on CdTe.

1. Ray S., et al. *Synthesis and characterization of Cu doped CdTe thin films for solar cell application // Materials Today: Proceedings.* -2021.- 39. P. 2000-2004.

2. Patel S. L., et al. *Towards cost effective absorber layer to solar cells: Optimization of physical properties to Cu doped thin CdTe films // Materials Letters.* -2019.-254.-P. 141-144.

3. Prokopiv V.V, et al. *Optical properties of CdTe doped with Ca // Physics and Chemistry of Solid State.* -2020. -21, N 1. -P. 52-56.

4. Yavorskyi R.S., et al. *Vapor Phase Condensation for Photovoltaic CdTe Films // Physics and Chemistry of Solid State.* -2017.-18, N 4.-P. 410-416.

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