



# 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”**

**(NANO-2021)**

**25-27 August 2021**

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This book contains the abstracts of contributions presented at the International research and practice conference “Nanotechnology and Nanomaterials” (NANO-2021).

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.

Website of the NANO-2021 conference: <http://nano-conference.iop.kiev.ua/>

## **Influence of the deformation mode on the formation of nanostructure, surface relief and wear resistance of steel 40kh**

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The most common method of forming nanocrystalline structures (NCS) is severe plastic deformation (SPD). Thus form volumetric and surface NCS. One of the methods of forming the surface NCS is mechanical pulse treatment (MPT), where the source of SPD is high-speed friction. Such nanostructure with a grain size of 12-60 nm increases wear resistance, resistance to fatigue and corrosion-fatigue fracture, serves as a barrier to penetration of hydrogen into the matrix material. Kinematically MPT is identical to the grinding process. Hardening occurs in the area of frictional contact (FC) of the tool and the workpiece. The working part of the tool has a width of 5-8 mm. The transformation of the microstructure due to SPD is strongly depended on the deformation mode. Therefore, tools have been developed that implement unidirectional and multidirectional deformation. Tools with a special profile of the working surface realizing multidirectional deformation improve the dispersion of the structure and, therefore, the physical and mechanical properties of the hardened surface layer, as well as reduce the components of the friction force in the FC zone during MPT by facilitating the conditions for the nucleation and generation of dislocations. Such deformation provides an effective mechanism for the dislocation multiplication by cross sliding, which leads to the formation of a dislocation line of great length, which passes from one parallel plane to another. This leads to an increase of microhardness and an improvement of the surface relief on steel 40X (0.4C-1Cr). In particular, the surface of the core increases, that is, the surface, with the exception of the hills and troughs protruding beyond the core, changes the character of the reference curves taken on the "Talyscan150" profiler by "Taylor Hobson" in accordance with ISO 25178 – 2: 2012 Geometrical Product Specifications (GPS) – Surface texture: Profile method. The facilitation of the deformation process also leads to an increase of processing productivity. Simultaneously, the grain size decreases, the microhardness increases from 8.6 to 9.0 GPa, and especially the depth of the hardened surface layer increases from 200 to 350  $\mu\text{m}$ . This, accordingly, leads to a decrease in the dry friction coefficient and an increase in the wear resistance of the nanostructured surface.

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Наукове видання

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**Virtual NANO event** – In 2021 the NANO Conference was combined with a virtual platform for b2b and s2b communication for promotion international Research and Business Partnerships. The networking matchmaking event Virtual NANO-2021 was organized by the Enterprise Europe Network - Ukraine Consortium. Virtual NANO-2021 brings together researchers, scientists, engineers, business, technical and policy professionals to promote research and industrial collaborations, identify priorities, and strengthen the innovation ecosystem.

## Our publications



Abstracts Book of the 1st International Summer School (2012)  
 Abstracts Book of the 1st International Summer School and International Conference NANO-2013  
 Abstracts Book of the 2-nd International Summer School and International Conference NANO-2014  
 Abstracts Book of the 3-rd International Conference NANO-2015  
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 Abstracts Book of the 7-th International Conference NANO-2019

O. Fesenko, L. Yatsenko and M. Brodin et al. (eds.), *Nanomaterials, Imaging techniques, Surface Studies, and Applications*, Springer Proceedings in Physics 146, DOI: 10.1007/978-1-4614-7675-7, ©Springer Science+Business, Media, New York 2013

O. Fesenko, L. Yatsenko (eds.), *Nanocomposites, Nanophotonics, Nanobiotechnology, and Applications*, Springer Proceedings in Physics 156, DOI: 10.1007/978-3-319-0661-0, ©Springer International Publishing, Switzerland 2014

O. Fesenko, L. Yatsenko, *Nanoplasmonics, Nano-Optics, Nanocomposites, and Surface Studies* 167, DOI: 10.1007/978-3-319-18543-9, ©Springer International Publishing, Switzerland 2015

O. Fesenko, L. Yatsenko, *Nanophysics, Nanophotonics, Surface Studies, and Applications* 183, DOI: 10.1007/978-3-319-30737-4, ©Springer International Publishing, Switzerland 2016

Participants of International Summer Schools and International NANO Conferences – published their articles in Special Issue of Springer Open Journal "Nanoscale Research Letters" (in 2013, 2014 and 2015) dedicated to NANO Conferences. Impact Factor of Journal – 2.779.

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