INTERNATIONAL RESEARCH AND PRACTICE CONFERENCE "NANOTECHNOLOGY AND NANOMATERIALS"

21-24 of August 2024

Uzhhorod, UKRAINE

Abstract book

UDK 536:669

The International research and practice conference "Nanotechnology and nanomaterials" (NANO-2024). Abstract Book of participants of the International research and practice conference, 21–24 August 2024, Uzhhorod. Edited by Dr. Olena Fesenko. – Kyiv: , 2024. – P. 640.

This book contains the abstracts of contributions presented at the International research and practice conference "Nanotechnology and Nanomaterials" (NANO-2024).

The NANO-2024 Conference was organized by the Institute of Physics of NAS of Ukraine with the participation of the University of Tartu (Estonia), the Uzhhorod National University, University of Turin (Italy) and Pierre and Marie Curie University – Paris 6 (France).

NANO-2024 is the 12th conference in the series of NANO-conferences initiated by the Institute of Physics of NAS of Ukraine in 2012 in the framework of FP7 Nanotwining 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 2014-2017, 450 scientists took part and in 2018 it gathered above 650 participants. In 2021 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, India, Algeria, Indonesia and other countries. In 2021 - 2023 the Organizer Committee has received more than 800 application forms from about 25 countries of the world each years.

The NANO-2024 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.

This year, the conference is organized with the support of the project "Knowhow Communities for Accelerating RTI Transfer in the Danube Region" (RTIT>>), DRP0200330.

Website of the Nano-2024 conference: http://nano-conference.iop.kiev.ua

ISBN: 978-617-8092-32-0

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Welcome to International Conference «NANOTECHNOLOGY AND NANOMATERIALS»!



It gives me a great pleasure to welcome you all at the International Conference "Nanotechnology and nanomaterials" (NANO-2024) that will be held in Uzhhorod from August 21 to 24, 2024. Its aim is to promote scientific contacts and discussions between researchers representing various fields.

Previous NANO Conferences, held in Ukraine in 2013-2023, allowed the participants, including young scientists, to familiarize with current research and application problems in this area and thus forward implementation of nanotechnologies into innovations meeting public needs. The events also gave the opportunity to young and early-career researchers to attend lectures of internationally recognized experts and roundtable discussions on the emerging fields in nanosciences and nanotechnologies.

Our previous International Conferences and Summer Schools received positive feedback from international experts and from the media. Now we are holding the 12th such meeting, for which we are deeply grateful to its indefatigable initiator and organizer, Dr. Olena Fesenko and all her assistants, as well as to the universities and institutes that hospitably welcome the participants.

This year above 600 registration forms have been received from scientists representing more than 30 countries. We especially appreciate the participation in the conference of our foreign colleagues, both those who attend here and those who communicate their works remotely.

The fruitful cooperation of scientists is highly important not only to science itself. It helps us to overcome political and war conflicts and misunderstandings and to find our just peaceful future, which is now vitally important not only to Ukraine but also to other countries.

I wish the participants of the Conference to successfully share and broaden their knowledge in nanoscience and nanotechnologies, to advance the networking and launch new contacts between academia and research players in this area, and thus to create a good basis for further practical contributions. Events like these are especially important in the context of Ukraine's reconstruction after our victory, which I sincerely wish for all participants.

May good health serve us and promote creative success in our research!

Academician of NAS of Ukraine,
Professor **Anton G. Naumovets**



Group photo of participants of the 1st International Summer School for young scientists "NANOTECHNOLOGY: from fundamental research to innovations" (Bukovel 2012)



Interview with Prof. Dr. Thomas A. Klar, Director of the Institute of Applied Physics, Johannes Kepler University of Linz, Austria



At the lecture during the 1st International Summer School



Summer school participants on the background of the monument, which is a symbol of the geographical center of Europe (Rakhiv district)



Closing ceremony of the 1st International Summer School for young scientists "NANOTECHNOLOGY: from fundamental research to innovations"



Group photo of the 2nd International Summer School participants
(Bukovel 2013)



Summer School participant
PhD. Vorokhta M. (Czech Republic)
tries to play trembita



Plenary Session



The organizing committee
working hard



PhD. Lyashchova A.G.
(Ukraine)



Group photo of 1st International NANO–2013 Conference participants (Bukovel 2013)



Opening speech by Dr. habil. Emmanuelle Lacaze (France)



Online presentation of the Springer book with selected proceedings of the 1st International Summer School



Head of the Local organizing committee Dr. O.Fesenko



Excursion to the city of Lviv



Group photo of 3rd International Summer School participants (Yaremche 2014)



Discussion with speaker



Hiking the path of Dovbush, Carpathians



Director of Institute of Physics of NAS of Ukraine Prof. Leonid Yatsenko awards prizes to the winners of competition



Interview with Prof. Leonid Chernozatonskiy from Prokhorov Institute of general physics



Group photo of the 3rd International NANO-2014 Conference participants (Lviv, 2014)



Choir of Lviv National Ivan Franko University performsthe national anthem of Ukraine



Opening speech of Rector of Ivan Franko National University of Lviv, Prof. Volodymyr Melnyk



Report of Prof. Francesco Bonaccorso, leading specialist in graphene investigations



Scientific discussion with the audience



Group photo of the 3rd International NANO-2015 Conference participants (Lviv 2015)



Scientific discussion with the audience



Report of Prof. Dr. Thomas A. Klar, Director of the Institute of Applied Physics, Johannes Kepler University of Linz, Austria



Ivan Franko National University of Lviv violin ensemble performans



"Cheremosh" folk song and dance ensemble during the Conference opening ceremony



Group photo of the 4th International NANO-2016 Conference participants (Lviv 2016)



Scientific discussion with the audience



Report of Prof.Dr S. S. Choi (South Korea)



Registration of participants



Excursion to the Museum of Folk Culture and Rural Life in Lviv



Group photo of 5th International Summer School participants
(Bukovel 2017)



Scientific reporting



Report of Prof. Dr Stefano Bellucci



Tourist complex Mygovo



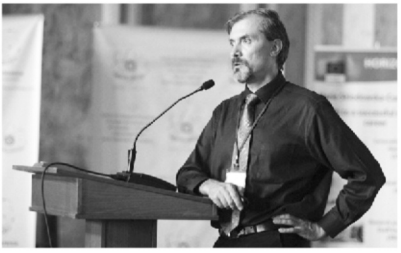
Don’t forget for dinner barbeque



Group photo of the 5th International NANO-2017 Conference participants (Chernivtsi 2017)



Report of heads of conference



Report of Prof. Dr. Vadym Mochalin (USA)



Registration of participants



Symphonic orchestra of Chernivtsi



Group photo of the 6th International NANO-2018
Conference participants (Kyiv 2018)



Registration of participants



Report of Dr. Hanna Morozovska
(Ukraine)



Discussion during the poster session



Organizing committee
of NANO-2018



Presentation of Philippe Mariani, CEO of Sophia Antipolis Foundation



Interview for a media



Experts in innovative ecosystem



Discussion with the audience



Expexerpt commmittemitet chee choooseosses the best startups



Presentation of Philippe Mariani, CEO of Sophia Antipolis Foundation



Registration of the participants



Report of Prof. Andzey Suchocki (Austria)



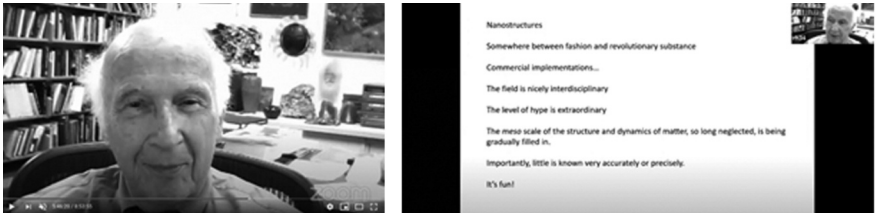
Mr. Jastin Taruska, member of the Innovation start-ups competition jury



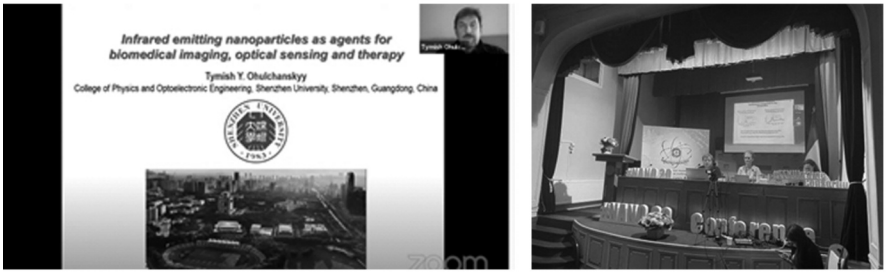
Awarding the winners of the Innovation start-up competition



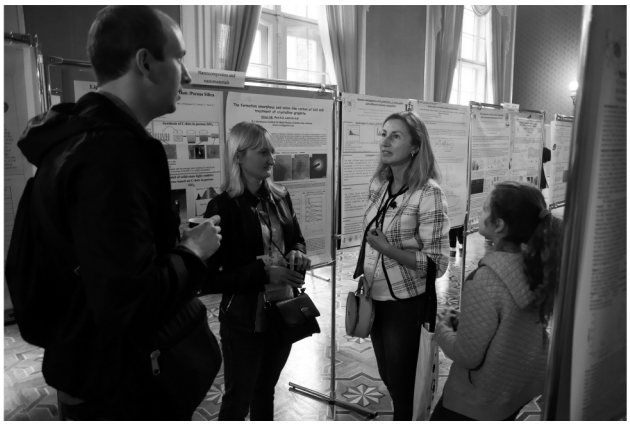
A collective photo of the participants of the NANO-2020 conference
on the stairs of the Lviv House of Scientists



Online speech by Nobel laureate Roald Goffman



Online and offline speech by Prof. Tymish Y. Ohulchanskyy
and Dr. Sergey Kolotilov respectively



A participant of the NANO-2021 conference presents his poster to colleagues



Participant of the NANO-2021 conference presents his oral report



General photo of NANO-2021 conference participants after all official events



General photo of NANO-2022 conference participants after all official events



Excursion around Lviv organized for participants of NANO-2022 by the organizing committee



NANO-2022 hosts ensure stable broadcast operation



Organizing committee of NANO-2022



A participant of the NANO-2022 conference presents her poster



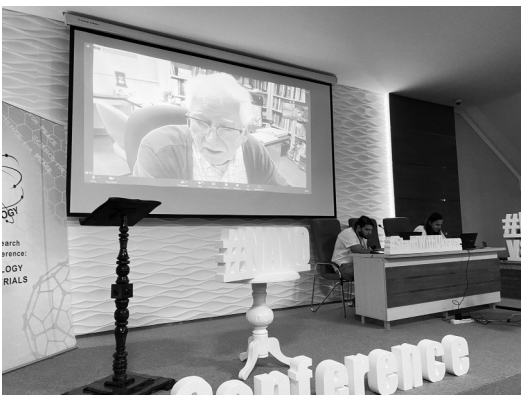
Participant of the NANO-2022 conference presents his oral report



Organizing committee of NANO-2022



Group photo of 11th International NANO–2023 Conference participants (Bukovel 2023)



Online speech by Prof. Roger M. Leblanc (University of Miami, USA)



Discussion of the participant's report in a relaxed atmosphere



Oral presentation by a young researcher



Questions from the audience are always welcome



Official Launch of the RTIT Project: Institute of Physics - Ukraine's Representative and Executor

We are pleased to announce the official launch of the RTIT project, aimed at supporting small and medium-sized enterprises (SMEs) in the materials sector. Over the next two years, the project will provide assistance to SMEs through a network of specialized communities in the Danube region, which plays a key role in materials production and manufacturing.

The Institute of Physics represents Ukraine as the executor of this project, working towards the creation and strengthening of knowledge communities and innovative methods in the field of materials science.

The RTIT project is implemented under the Danube Region Program and co-financed by the European Union, ensuring the necessary support and resources for the development of the materials sector.



Partner meeting of the project within the framework of the study visit to Nuremberg

On May 28 and 29, a study visit was held in Nuremberg as part of the RTIT project. Thirteen project partners from eight countries gathered to exchange ideas on knowledge transfer, technology, and innovation.

The event provided an excellent opportunity for a partner meeting, during which the results were summarized, the implementation schedule, achieved results, knowledge-sharing community activities, and organizational contributions were discussed. Partners reviewed the activity report on policy mapping, identifying gaps, and opportunities.

Next steps, role distribution, and responsibilities in implementing project activities were also planned.





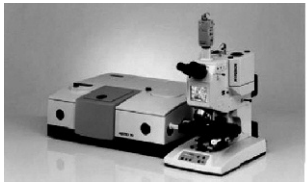
We would like to remind you that the aim of the RTIT project is to support small and medium-sized enterprises in the materials sector over the next two years through a network of specialized communities in the Danube region, which plays a key role in the production and manufacturing of materials. The project is implemented within the framework of the Danube Region Programme and co-financed by the European Union.

INTERNATIONAL LABORATORY "SURFACE ENHANCED SPECTROSCOPY"

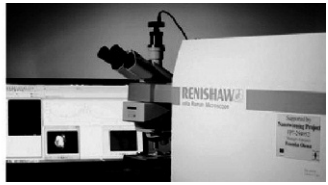
The International "Surface enhanced spectroscopy (SES)" laboratory was created at the International Research and Innovation Cooperation, Technology Transfer Department of the Institute of Physics of NAS of Ukraine in the framework of implementation of Nanotwinning Project. This laboratory has a close cooperation withits Partners: Institute of Physics of the University of Tartu (Estonia), Pierre and MarieCurie University (France), and University of Turin (Italy).

Main activity: Study of mechanisms and effects of the enhancement of optical signals from bioorganic molecules near metal and non-metal (carbon, graphene) surfaces using IR and Raman spectroscopy, creation of a new type of substrates for spectroscopy, applications of Surface enhanced Infrared absorption (SEIRA) and Surface enhanced Raman scattering (SERS) spectroscopy.

Equipments: FTIR Spectrometer VERTEX 70 equipped with FTIR microscope HYPERION 1000 (Bruker, Germany), inVia micro-Raman spectrometer (Renishaw,England), UV-2600 spectrophotometer (Shimadzu, Japan) with diffuse reflectance attachment and all needed equipment for sample preparation, HEX deposition system (Korvus Technology, United Kingdom).



FTIR Spectrometer VERTEX 70 (Bruker, Germany)



InVia micro-Raman spectrometer with lasers λ = 786 and 633 nm (Renishaw, England)

The International Laboratory Team has many years' experience in preparation, implementation and management of International Projects.

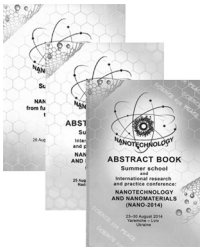
Laboratory's Projects:

– STCU Project "Rose";
– FP7-PEOPLE-2013-IRSES, Marie Curie actions;
– FP7 Nanotwinning project No 294952;
– NATO "Science for Peace" Project NUKR.SFPP 984702;
– Horizon2020_COS-EEN Project for 2016–2020 years.

We are interested in cooperation in the field of development of scientific and infrastructural International projects in the frame of Horizon2020 and others Programs.

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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 2nd International Summer School and International Conference NANO 2014

Abstracts Book of the 3nd-11nd International Conference NANO-2015-NANO-2023

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

O. Fesenko, L. Yatsenko, Nanocomposites, Nanostructures, and Their Applications 221, DOI: 10.1007/978-3-030-17759-1, ©Springer International Publishing, Switzerland 2019

O. Fesenko, L. Yatsenko, Nanomaterials and Nanocomposites, Nanostructure Surfaces, and Their Applications 263, https://doi.org/10.1007/978-3-030-74741-1, O. Fesenko, L. Yatsenko, Nanophotonics, Nanooptics, Nanobiotechnology, and Their

Applications 222, DOI: 10.1007/978-3-030-17755-3, ©Springer International Publishing, Switzerland 2020





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.

In 2016-2018 it was also possible to publish an articles for participants of the NANO conference in Applied Nanoscience Journal, The European Physical Journal Plus (EPJ Plus) and Applied Sciences Journal (SN).

www.springer.com/materials/nanotechnology/journal/11671

Also, since 2017 year it was possible to publish the articles for participants of NANO Conference in the Molecular Crystals and Liquid Crystals Journal

https://www.tandfonline.com

Our Partners:

EEN-Ukraine consortium

The Enterprise Europe Network helps businesses innovate and grow on an international scale. EEN-Ukraine Consortium can help you to find investors, international partners and promote your innovation products. Our contacts:

Website of Consortium: http://www.iop.kiev.ua/~een/

E-mail: een.network.ukraine@gmail.com

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The Enterprise Europe Network (EEN) is a service that provides support for Small and Medium-sized Enterprises (SMEs) with international ambitions. Co-funded by the European Union's COSME and Single market programmes, the Network's aim is to help businesses innovate and grow internationally.

The Enterprise Europe Network was launched on 7 February 2008 by former EU Commissioner Günter Verheugen. The Enterprise Europe Network combines the previous Euro Info Centres and the Innovation Relay Centres. From 2008 to 2014, the Network was co-financed by the EU's Competitiveness and Innovation Framework Programme (CIP), in cooperation with institutions at national and regional levels. From 2015-2024, the Network is co-financed under the European Union's programme for the competitiveness of SMEs (COSME) and Single market.

Under the responsibility of the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, the Enterprise Europe Network is managed by the Executive Agency for Small and Medium-sized Enterprises (EASME).

The Network is active in more than 70 countries worldwide. It brings together 6,000 experts from more than 600 member organisations, including:

- chambers of commerce and industry
- technology poles
- innovation support organisations
- universities and research institutes
- regional development organisations

Enterprise Europe Network innovation support services are available based on an assessment of the needs and development phase of the business.

At an entry level, Network services include:

- information on innovation-related policies, legislation and support programmes
- links with local innovation stakeholders
- information about access to local sources of funding/support

Network experts can provide one-to-one services to support innovation capacity building. Services include innovation audits, advice on intellectual property, marketing and access to finance.

Finally, the Network provides consulting services and support to innovative SMEs and technology companies in preparing project proposals for the Accelerator programme, part of the European Innovation Council (EIC) pilot.

In 2017, Ukraine joined the European Enterprise Network (EEN) within the framework of the COSME program, which promotes the competitiveness and innovative development of SMEs, innovation organizations and institutes/ universities. For this purpose in Ukraine was created a Consortium EEN-Ukraine, which included representatives of business and government agencies, as well as scientific organizations.

To contact EEN-Ukraine please follow the website

https://eenukraine.com/

E-mail: een.network.ukraine@gmail.com

Phone: +380 44 525 9841

Session 1
Nanocomposites and Nanomaterials

Doped cobalt ferrite as a heterogeneous catalyst for water treatment

Lapchuk I. V.*, *Tatarchuk T.R.

Educational and Scientific Center of Materials Science and Nanotechnology Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, 76018, Ukraine, ivannalapchyk@gmail.com

Water pollution is one of the world's major problems. Oil product emissions, and medical, industrial, and domestic wastewater lead to surface water pollution. Consequently, there is a pressing need to identify an efficacious, cost-effective, and environmentally benign method for water treatment.

$CoFe_2O_4$ exhibits excellent magnetic and catalytic properties, is chemically stable, and possesses high mechanical hardness. The doping of transition metal ions to $CoFe_2O_4$, in particular, Mn^{2+}, Zn^{2+}, and Cu^{2+} allows for the modification of properties according to the intended application. Ion substitution changes magnetic properties, saturation magnetization, surface area, and particle size. As a result, the catalytic properties of ferrites can also be improved as a result of structural and morphological changes. The distinctive properties of doped ferrites render them more effective heterogeneous catalysts than other iron oxides [1–2]. Doped cobalt ferrites have been demonstrated to be effective catalysts for the decomposition of organic matter in water and microbiological pollutants. Consequently, the research of these promising materials will facilitate the improvement of synthesis methods, enhance catalysts' efficiency, and guarantee the effective purification of water.

1. A. Soufi, H. Hajjaoui, R. Elmoubarki, M. Abdennouri, S. Qourzal, N. Barka, Spinel ferrites nanoparticles: Synthesis methods and application in heterogeneous Fenton oxidation of organic pollutants – A review, Appl. Surf. Sci. Adv. 6 (2021) 100145. https://doi.org/10.1016/j.apsadv.2021.100145.

2. S.I. Ahmad, Nano cobalt ferrites: Doping, Structural, Low-temperature, and room temperature magnetic and dielectric properties – A comprehensive review, J. Magn. Magn. Mater. 562 (2022) 169840. https://doi.org/10.1016/j.jmmm.2022.169840.

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The **Enterprise Europe Network** is a service that provides support for Small and Medium-sized Enterprises (SMEs) with international ambitions. Co-funded by the European Union's COSME and Horizon 2020 programmes, the Network's aim is to help businesses innovate and grow internationally.

The Enterprise Europe Network was launched on 7 February 2008 by former EU Commissioner Günter Verheugen. The Enterprise Europe Network combines the previous Euro Info Centres and the Innovation Relay Centres. From 2008 to 2014, the Network was co-financed by the EU's Competitiveness and Innovation Framework Programme (CIP), in cooperation with institutions at national and regional levels. From 2015-2020, the Network is co-financed under the European Union's programme for the competitiveness of SMEs (COSME) and Horizon 2020.

Under the responsibility of the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, the Enterprise Europe Network is managed by the Executive Agency for Small and Medium-sized Enterprises (EASME).

The Network is active in more than 60 countries worldwide. It brings together 3,000 experts from more than 600 member organisations, including:

- chambers of commerce and industry
- technology poles
- innovation support organisations
- universities and research institutes
- regional development organisations

Enterprise Europe Network advisory services support businesses seeking to expand into international markets. The services cover a wide range of regulatory areas and market intelligence:

- Compliance with EU regulations and standards (e.g. CE marking)
- Access to international markets – market intelligence and capacity building
- International public contracts – access to cross-border procurement and EU tender opportunities
- National and regional finance and funding – identification of sources of finance and investor-readiness training
- EU funding schemes and application support
- Intellectual property rights (IPR) – patents and IPR applications and exploitation strategies
- Energy and resource efficiency – identification of technologies and finance opportunities
- Management improvement – capacity building

Enterprise Europe Network innovation support services are available based on an assessment of the needs and development phase of the business.

At an entry level, Network services include:

• information on innovation-related policies, legislation and support programmes

• links with local innovation stakeholders

• information about access to local sources of funding/support

Network experts can provide one-to-one services to support innovation capacity building. Services include innovation audits, advice on intellectual property, marketing and access to finance.

Finally, the Network provides key account management services to businesses benefitting from the Horizon 2020 SME instrument programme, part of the European Innovation Council (EIC) pilot.

In 2017, Ukraine joined the European Enterprise Entrepreneurship Network (EEN) within the framework of the COSME program, which promotes the competitiveness and innovative development of small and medium-sized enterprises, innovation organizations and institutes / universities. For this purpose in Ukraine was created a Consortium EEN-Ukraine, which included representatives of business and government agencies, as well as scientific organizations.

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This year, the conference is organized with the support of the

RTIT project, aimed at supporting small and medium-sized enterprises (SMEs) in the materials sector. Over the next two years, the project will provide assistance to SMEs through a network of specialized communities in the Danube region, which plays a key role in materials production and manufacturing.

The Institute of Physics represents Ukraine as the executor of this project, working towards the creation and strengthening of knowledge communities and innovative methods in the field of materials science.

The RTIT project is implemented under the Danube Region Program and co-financed by the European Union, ensuring the necessary support and resources for the development of the materials sector.

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Наукове видання

The International research and practice conference "Nanotechnology and nanomaterials" (NANO-2024)

Book of abstracts is published in authors' edition without modifying by the Organizing Committee

Head of Organizing Committee:
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Design and layout: *Volodymyr Havlo.*

Technical support in the course of the International conference (NANO-2024). Junior Researchers of the Institute of Physics of the NAS of Ukraine A.D. Yaremkevych (media assistance) and Y.S. Kifiuk (sound equipment), M.V. Rallev (informational and transportation support), O.P. Budnyk (registration of participants and excursions), P.V. Golub (registration of participants and general questions), V.S. Tkachenko (registration support), A.V. Klochek (registration of participants and general question), T.V. Tsebrienko (registration support), E.V. Leonenko (registration of participants and general questions), S. Starinets (registration of participants), V.O. Hryn (photo report).

Підписано до друку 04.08.2024. Формат 60x84/$_{16}$.
Папір офсетний. Друк офсетний. Умовн. друк. арк. 3,48.
Наклад 300 прим.Зам. № .

ТзОВ "Галицька видавнича спілка"
вул. Тугана-Барановського, 24, м. Львів, 79005,
тел.: (032) 276-37-99
Свідоцтво суб'єкта видавничої справи ДК № 7408 від 27.07.2021 р.

Друк:

ТзОВ "РВФ "Поліграф-сервіс"
вул. Грабовського 11/13, м. Львів, 79008
тел.: (067) 673-85-75
Свідоцтво про внесення суб'єкта видавничої справи до державного реєстру видавців, виготовників і розповсюджувачів видавничої продукції серія ДК № 3900 від 14.10.2010