Institute of Physical Chemistry
Polish Academy of Sciences

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Dioscuri

Registration form for Polish scientific institution

1. Scientific institution data:
   Institute of Physical Chemistry, Polish Academy of Sciences, M. Kasprzaka 44/52, 01-224 Warsaw, Poland

2. Type of scientific institution:
   scientific unit of the Polish Academy of Sciences

3. Head of the Institution:
   prof. dr hab. Marcin Opałło

4. Contact information of designated person for applicants and NCN: first and last name, position, e-mail address, phone number, correspondence address:
   prof. dr hab. Robert Hołyst, professor, rholyst@ichf.edu.pl , +48 22 343 3123, Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44/52,01-224 Warsaw, Poland

5. Science discipline in which strong international position of the Institution ensures establishing a **Dioscuri Centre**:
   Physical and analytical chemical sciences

6. Description of important research achievements from the selected discipline from the last 5 years including list of the most important publications, patents, other

Current scientific profile of the Institute of Physical Chemistry of the Polish Academy of Sciences is strongly related to the newest global trends in **physical chemistry inspired by biology, biochemistry, biotechnology, astrochemistry, medicine, modern materials chemistry and advanced measurement techniques** that can be used in medical diagnostics, photovoltaic, pharmaceutical and optics. Scientific research covers a wide range of topics and is being implemented in 28 research teams (see www.ichf.edu.pl). Trends in research at the Institute correspond to those of the best European Research Areas (ERA). This is evidenced by, among others, the number of publications of the Institute scientists and the increase in the quality of these publications measured by the Impact Factor. **Between 2013 and 2017, IChF researchers published almost 1100 scientific articles** (according to the Web of Science), it is more than 200 articles a year. The quality of these articles is rising every year, it is reflected in the increase in the number of publications with an Impact Factor above 5, which in the last four years was as follows 2013 - 39, 2014 - 39, 2015 - 49, 2016 – 60, 2017-55 (including 49 with IF>6),

The most important publication:

1. **CHEMICAL REVIEWS,** 2017, 117, 2447-2480, **IF=47,9** Spectroscopy and Tautomerization Studies of Porphycenes
2. **CHEMICAL SOCIETY REVIEWS,** 2017, DOI: 10.1039/c5cs00717h, **IF 38,618** Controlled droplet microfluidic systems for multistep chemical and biological assays
3. **CHEMICAL SOCIETY REVIEWS,** 2014, 43, 765-778, **IF 30,425** Heterogeneous photocatalytic nanomaterials: prospects and challenges in selective transformations of biomass-derived compounds
4. **NATURE CHEMISTRY,** 2016, 8(10), 935-940 , **IF 27,893** Force-induced tautomerization in a single molecule
5. **PROGRESS IN POLYMER SCIENCE,** 2015, 47, 1, 9171-9179, **IF 26,932** Functionalized polythiophenes: Recognition materials for chemosensors and biosensors of superior sensitivity, selectivity, and detectability
6. **ANGEWANDTE CHEMIE-INTERNATIONAL EDITION,** 2013, 52 ,13414-13418, **IF 13,734** Permanent porosity derived from the self-assembly of highly luminescent molecular zinc carbonate nanoclusters

In addition to fundamental research, the Institute conducts research application and implementation work. **In the years 2013-2017 the Institute has obtained 114 patents, including 30 foreign and 4 protection rights for utility models and made 109 patent applications.**The most important patents:

1. System and method for automated generation and handling of liquid mixtures, **Patent US 9,132,396**
2. Substrate for surface enhanced Raman scattering studies, **Patent US 8,531,660**
3. Luminescent compounds, method of preparation of luminescent compounds and applications thereof, **Patent US 9,217,104**
4. Method for splitting droplets in microfluidic junction and system for splitting droplets in microfluidic junction, **Patent GB 495182**
5. Method for depositing metal nanoparticles on the surface, the surface fabricated with the method and the application thereof, **Patent NL 2009442**

7. List of no more than 3 important research projects from the selected discipline awarded in national and international calls to the institution in the last 5 years (title, name of PI, source of funding, amount of founding):

    1. The CREAtion of the Department of Physical Chemistry of Biological SysTEms (CREATE), prof. dr hab. Robert Hołyst, Research Executive Agency, 2 488 611,00 Euro,
    2. Interdisciplinary NAnoscience School: from phenoMEnology to applicationS (NaMeS), prof. dr hab. Robert Hołyst, Agnieszka Tadrzak, prof. dr hab. Robert Kołos, Research Executive Agency, 2 302 080.00 Euro
    3. New technological advances for the third generation of Solar cells (GOTSolar), prof. dr hab. Janusz Lewiński, Research Executive Agency, 326 450 Euro.

8. Description of the available laboratory and office space for Dioscuri Centre:

    Institute of Physical Chemistry offers for Dioscuri Centre fully equipped new chemical laboratory of 46 square meters surface, air conditioned, ventilated with two fume hoods and all required accessories. Offered office includes fully furnished place (20 square meters) designated for 6 people. The lab and office are located in a newly built laboratory building on the site of the Institute.

9. List of available scientific equipment for *Dioscuri Centre*:

Institute of Physical Chemistry offers free access to nine specialized laboratories with experienced staff :

1. Laboratory of X-ray Structural Analysis specialized in investigation of crystal and molecular structures by X-ray diffraction on single crystals and powder specimens. Equipped with two automatic diffractometers for single crystals, and two powder diffractometers, is prepared to perform a complete structural analysis from data collection through data reduction, structure solution, structure refinement to graphical representation of the structure.

2. Laboratory for NMR Spectroscopy is being prepared for solid state research in possibly wide temperature range, with application of possibly wide spectrum of experimental techniques. The laboratory is equipped with 2 superconducting wide-bore magnets with magnetic fields of 7.04 and 11.74 T (300 and 500 MHz, respectively).

3. Laboratory of Chromatograph Analysis performs chromatographic studies of mixtures which are otherwise separable with difficulty. The laboratory is equipped with gas chromatographs with FID detectors, liquid chromatographs with DAD detector and UV-VIS detector and Apparatus for Capillary Electrophoresis with DAD detector.

4. Laboratory for Soft Matter Research performs measurements: dynamic and static light scattering, Zeta potential, viscoelastic properties and viscosity, density, refractive index, thermal effects (DSC-TG), spectral studies in the UV-VIS.

5. Laboratory for Molecular Films Research is to investigate molecular film by means of non-destructive experimental techniques. The characterization is performed with spectroscopic or imaging methods. The Laboratory is equipped with apparatus which enables measurements in wide spectral range, in particular: from ultraviolet (UV) to middle infrared (MIR).

   LMFI is equipped with following apparatus:

   - Fourier Transform Infrared (FTIR) spectrometer working in MIR spectral range;
   - Spectroscopic Ellipsometer covering spectral range from ultraviolet (UV) to near infrared (NIR);
   - Brewster Angle Microscope (BAM) conjugated with Langmuir-Blodgett Trough (LB Trough).

   The analysis of vibrational spectra includes simulation of vibrations active in infrared and/or Raman scattering. Theoretical spectra are calculated with Density Functional Theory (DFT) method.

6. Mechanical Laboratory carries out all kinds of services in the field of machining and in the field of precision mechanics - construction of equipment, assembly, repair and regeneration.

7. Laboratory of Scanning Electron Microscopy can be used to image the surface of materials by scanning electron microscopy (SEM) with resolution up to several nanometers. The SEM microscope is also equipped with EDS and WDS detectors for basic analysis of the chemical composition of the samples. LSME can be used to image the surface of materials by scanning electron microscopy (SEM) with resolution up to several nanometers. The SEM microscope is also equipped with EDS and WDS detectors for basic chemical analysis of the samples.

8. Laboratory of Surface Analysis realizes research on physical chemistry of elemental and complex solid surfaces, including metals, metallic alloys, composites, polymers, metallic particles/nanoparticles deposited on various inorganic/organic supports and semiconductor compounds, focused on the characterization of stoichiometry, chemical state and morphology. For this purpose the following analytical methods are used: XPS (ESCA) X-ray photoelectron spectroscopy, (AES) Auger Electron Spectroscopy, (EPES) Elastic Peak Electron Spectroscopy, (AFM) Atomic Force Microscopy, (STM) Scanning Tunneling Microscopy, (LEED) Low-Energy Electron Diffraction. A detailed list of equipment is available on the website http://groups.ichf.edu.pl/laboratories/pisarek/apparatus

9. Biological laboratories: Laboratory of mammalian cells (fully equipped), laboratory for bacteria (class I and II), laboratory for study of bacteriophages. (confocal microscopes with fluorescence correlation spectroscopy, microscopes with microinjection set-up).

10. List of additional benefits that the institution declares to provide for *Diosuri Centre* (i.e.: additional funds, personal benefit, other)

1. **The Institute offers extra 3 PhD positions for PI.**
2. Medical insurance benefit under a group contract
3. Individual health care within a commercial health package
4. Well equiped chemical library, parking and canteen at the Institute campus
5. More than 8000 titles of scientific journals, 34,500 books and 30 databases available on company computers
6. Friendly administration implementing HR Excellence in Research Program.
7. Professional help for PIs interested in setting up their own start-ups (our PIs have established 4 spin-offs in recent 6 years).

8. Employees and PhD students are also entitled to profit from the **IPC Social Fund** – i.e. system of favorable loans for employees, and integration and cultural events for the IPC community (i.e. free tickets, integration picnics)

11. Other information about internationalization of the scientific institution, foreign scientists employed at the institution, availability of the English language seminars etc.:

Institute of Physical Chemistry of the Polish Academy of Sciences (IPC) conducts internationalization policy through the wider opening to foreign researchers and PhD students. IPC has made efforts to get the most talented foreigners to work in or collaborate with the Institute, and that researchers and PhDs have good access to the best research centers abroad. Institute staff actively participate in international scientific cooperation through joint publications, projects, internships, lectures and the organization of international conferences. At present, **25% of the Institute's scientists are foreigners** (55 people), 29 of them are PhDs. Among the 30 research groups working at the Institute, **5 is directed by foreigners**. **Most of the lectures and seminars are delivered in English**, the **Institute website** and **IPC procedures** (i.a. employment policy, indication and summary of major act of local law, list of consultative, appeal & decision-making bodies) **are available in English**.

In 2015, the European Commission granted the Institute the right to use the **HR Excellence in Research** mark for creating favorable conditions for scientific research and career development of scientists (http://ichf.edu.pl/IPC-HR_Excellence_in_Research.html)

Over the past four years**, Institute has cooperated** in formal and informal agreements **with more than 60 foreign scientific centers** including: Max Planck Institute in Mainz and Stuttgart, CNRS in Paris, Graz University of Technology, University of Cambridge, National Tatung University, Taipei. As a result of cooperation **more than 170 people left for short and long-term research visits**.

The Institute has been running **International Doctoral Studies** for many years and is currently training 94 PhD students. At present, the Institute has launched a project called "Interdisciplinary NAnoscience School: from phenoMEnology to applicationS" (www.names.edu.pl) under Horizon 2020. The project envisages the implementation of 22 doctoral research projects. The topic of doctoral research projects is in the most up-to-date basic research, but goes beyond the academic sector and shows good prospects for commercialization. With the implementation of these research projects, the Institute will collaborate with 20 foreign partners - universities and research institutes in Europe, USA and Canada as well as with innovative European companies.

In the years 2013-2017 the Institute **organized or co-organized over 20 international conferences**.

Currently, the Institute implements **5 projects within the Horizon 2020 Programme**:

• the CREATE project (ERA Chairs, CSA), which provides for the establishment of a new Chair in the Institute's structure;

• NaMeS project (COFUND program, MSCA), aimed at setting up international interdisciplinary and intersectoral (with enterprises) doctoral studies in nanosciences;

• GOTSolar for the development of new solar cells (FET-Open);

• METCOPH, which aims to prepare macrocyclic metal complexes for use in photonic devices (RISE, MSCA), IPC coordinates this project.

• CONIN (RISE, MSCA), supporting researchers studying the impact of space constraints on heterogeneous systems, IPC coordinates this project.