Registration form

This is a registration form for Host Institutions wanting to establish a Dioscuri Centre of Scientific Excellence within Dioscuri 4 call.

1. **Research institution data** (name and address):

Adam Mickiewicz University, Poznań (AMU)

Wieniawskiego 1

61-712 Poznań

Center for Advanced Technology, Adam Mickiewicz University, (AMU-CAT)

Uniwersytetu Poznańskiego 10

61-614 Poznań

2. **Type of research institution:**

    1) higher education institution

3. **Head of the institution:**

    AMU Rector Prof. dr hab. Bogumiła Kaniewska

4. **Contact information of designated person(s) for applicants and the NCN:**

    Prof. dr hab. Artur R. Stefankiewicz

    Vice-Director of the Center for Advanced Technology, Adam Mickiewicz University

    Email: ars@amu.edu.pl

    Phone: +48618291911/+48664499601

    Correspondence address:

    Center for Advanced Technology

    Uniwersytetu Poznańskiego 10, 61-614 Poznań, Poland.

5. Research discipline in which the strong international position of the institution ensures establishing a Dioscuri Centre:

Natural Sciences and Technology

☐ Mathematics

☐ Fundamental constituents of matter

☐ Condensed matter physics

☐ Chemistry

☐ **Materials**

☐ Computer science and informatics

☐ Systems and communication engineering

☐ Production and processes engineering

☐ Astronomy and space research

☐ Earth sciences

6. Description of important research achievements from the selected discipline from the last 5 years

The Center for Advanced Technology (CAT) is a well-established, modern research and development center of AMU located on Morasko Campus in Poznań. CAT is a scientific center build to unite the potential of all research institutes and universities in the field of advanced materials discovering, synthesis and characterization. CAT with multidisciplinary state-of-the-art infrastructure and experience gives the possibility to design **functional materials** for various innovative applications. CAT has profound expertise in smart synthesis with a particular focus on the generation of **functional nanomaterials** presenting potential application in many aspects of modern sciences including: sensing, water purification and energy storage. Numerous other possible technological applications of materials produced in the CAT, e.g. in photonics and flexible electronics, ranging from solar cells and light-emitting devices to touch screens, photodetectors, ultrafast lasers, spin valves, etc. are also being explored. The expertise of CAT encompasses several major fields of modern chemical and material sciences that can be further subdivided into more specialized areas such as: **(1) Functional Nanostructures, (2) Two-dimensional Materials, (3) Organometallic Catalysis, (4) Applied and Sustainable Catalysis, (5) Photoactive Materials**. In all these areas generation of functional materials of specific and highly desirable physicochemical properties and ultimately functions represents the major focus. Below we present selected examples of discoveries made in recent years in CAT: **(1)** Reversible interconversion between organic polymer and toroidal species has been readily achieved by simple control of metal ion concentration and resulted in the generation of dynamic adaptive materials of distinct fluorescent properties; a coordination cage that behaves as a liquid in the neat state has been synthesized and applied in the selective encapsulation of guest molecules; one of the largest nanocapsule acting as selective receptor for structurally distinct guest molecules has been discovered. **(2)** A facile approach to the bottom-up fabrication of a novel 3D sulfur−nitrogen functionalized graphene oxide material with high specific capacitances and good cycling stability has been demonstrated; a novel method to tune and boost the sensitivity of pressure sensors has been reported; atom-thick membranes for water purification and blue energy harvesting has been developed. **(3)** New catalytic system has been found to act as a new type of catalyst for regioselective hydrosilylation of alkynes by primary, secondary, and tertiary silanes; the first example of sodium triethylborohydride-catalysed hydrosilylation of alkenes has been described. **(4)** A new process option for carrying out continuous flow (asymmetric) transformations using a molecular catalyst immobilized via the SILP approach has been discovered; a highly efficient synthetic protocol leading to alkenyl boronates via catalytic hydroboration of various alkynes by the immobilization of the commercially available catalyst in ionic liquids or in the biphasic IL/supercritical CO_2 system was developed. **(5)** Application of fluorescence spectroscopy in the generation of light-harvesting hybrid materials has been described; a rapid and efficient method involving microwaves as the non-classical energy carrier has been successfully applied in the synthesis of a series of novel iridium(III) complexes. The literature describing the above discoveries is presented below: **(1)** ***J. Mater. Chem. C***, 2021, 10.1039/d0tc05598k; ***Adv. Sci.***, 2019, 6, 1900577; ***Nature Chem.***, 2020, 12, 270-275; ***Nature Commun.***, 2017, 8, 15109; ***Chem. Sci.***, 2019, 10, 1836-1843; ***Nanoscale***, 2020, 12, 4743 – 4750; **(2)** ***J. Am. Chem. Soc.*** 2019, *141*, 482; ***Energy Storage Mater.*** 2019, *17*, 186; ***Adv. Mater.*** 2019*, 31,* 1804600; ***Adv. Funct. Mater.*** 2020, *30*, 43851; ***ACS Nano*** 2017, 11, 10654; **(3)** ***Org. Lett.*** 2021, 10.1021/acs.orglett.0c03721; ***Chem. Commun.*** 2017, *53*, 5404–5407; ***Catal. Sci. Technol.*** 2020, *10*, 1066-1072; ***Dalton Trans.*** 2018, *47*, 5948–5951; **(4)** ***ACS Catalysis*** 2018, 8, 3297; ***ACS Sus.Chem.Eng.*** 2018, *5*, 10980; ***J. Catal.*** 2019**,** *376*, 219; ***Adv. Synth. Catal.*** 2018, 360, 2966; ***J. Catal.*** 2017, *356*, 206; **(5)** ***ACS Energy Lett.*** 2019, 4, 8, 1898–1901; ***J. Mater. Chem. C***, 2018,6, 8688-8708; ***Inorg. Chem.*** 2019, 58, 22, 15671–15686; ***J. Phys. Chem. C,*** 2020**,** 124, 19522-19529; ***J. Phys. Chem. C,*** 2020, 124, 29, 15769–15780.

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 funding):

1) ***Project SONATA BIS***: "Self-assembled porous capsules as multifunctional nanomaterials"

   Principal Investigator – Prof. dr hab. Artur R. Stefankiewicz

   Source of funding – National Science Centre, Poland

   Amount of funding – 2 474 520 PLN (ca. 552 000 €)

2) ***Project OPUS***: "Supramolecularly engineered sensors based on 2D materials for detection of gases and pressure"

   Principal Investigator – Prof. wiz. dr hab. Artur Ciesielski

   Source of funding – National Science Centre, Poland

   Amount of funding – 1 684 800 PLN (ca. 375 000 €)

3) ***Project SONATA BIS***: "The new approach to hydroboration reactions of the unsaturated carbon-carbon and carbon-heteroatom bonds in repetitive batch and continuous flow systems"

   Principal Investigator – Prof. UAM dr hab. Jędrzej Walkowiak

   Source of funding – National Science Centre, Poland

   Amount of funding – 2 896 460 PLN (ca. 645 400 €)

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

The prospective leader and the research group will be primarily affiliated with AMU-CAT. **AMU Center for Advanced Technology (AMU-CAT)** in Poznań is a multidisciplinary institution focused on designing and characterization of new materials, nano- and biomaterials of multiple applications. AMU-CAT combines the best specialists of natural and engineering sciences and is an infrastructural venture of the Poznan scientific community.
The major units of AMU-CAT include:

- Centre of Chemical Technology and Nanotechnology (B),
- Centre of Plant and Industrial Biotechnology (A) with a Greenhouse (A1),
- Centre of Medical Biotechnology (A) with an Animal House (A2),
- Centre of Material Sciences (C) with a Regional Laboratory of Unique Equipment.

The Service and Technical Facilities with the Technology Transfer Centre (D) that are functioning as one research organism. The total area of the WCAT is over 19 500 m^2 with more than 7 000 m^2 for the Centre of Chemical Technology and Nanotechnology (B) and Centre of Industrial Biotechnology (A) each as well as almost 3 000 m^2 of the Regional Laboratory of Unique Equipment. The highly specialized equipment placed in Regional Laboratory (building C) as well as laboratory spaces (building B) are available for use by the entire scientific community. The Centre has laboratories of different areas and equipment that allows their quick adaptation to the more specific needs. The laboratories are furnished and equipped with fume hoods and gas/water connections. Furnished offices, social rooms and conference and seminar rooms of different sizes are also available at the AMU CAT Center.

9. List of the available research equipment for the Dioscuri Centre:

The significant strength of AMU CAT is its great infrastructure (including modern and well-equipped labs, office space, and advanced research equipment) which might be a key motivation for potential candidates/partners of the Dioscuri action. The future Dioscuri Center staff will have a guaranteed access to a modern infrastructure and research equipment via specific agreement with Adam Mickiewicz University.

The list of available equipment for Dioscuri Center includes:

- Atomic Force Microscope Agilent 5500. AFM/STM in air or any atmosphere, liquids with variable sample temperatures (–20 to 200°C). Static and dynamic measurements, mapping surface properties (electrical, mechanical, magnetic), electrochemical cells, surface potential. Scan size up to 90 micrometers. Subnanometer resolution in x, y, z movements and cantilever deflection.

- Scanning Electron Microscope FEI Quanta 250 Feg. High resolution FEG-SEM with ESEM and STEM technology. Characterization of conductive and non-conductive samples with SE and BSE imaging possible in every mode of operation. Resolution in high vacuum - 0.8 nm at 30 kV (STEM), 1.0 nm at 30 kV (SE), 3.0 nm at 1 kV (SE); low vacuum 1.4 nm at 30 kV (SE), 3.0 nm at 3 kV (SE); extended vacuum mode (ESEM) 1.4 nm at 30 kV (SE). Analytical equipment: EDS, WDS, EBSD detectors (EDAX): allow determination of sample composition and crystallographic orientation.

- High-Performance Laser Scanning Microscope Olympus FV1200. Two GaAsP detectors, live cell imaging experiments, implementing real time Z-drift compensation and touch panel control. Confocal observation of fixed samples, with up to 5 simultaneous fluorescent detection channels; lasers: 405 nm, 458/488/515 nm, 559 nm, 635 nm.

- Scanning Electron Microscope with Focused Ion Beam FEI Helios Nanolab 660. Extremely high resolution (XHr), with subnanometer resolution from 500 V to 30 kV, sharp and charge free contrast obtained from up to 6 integrated in-column and below the lens detectors.

Ion Etching and Metals Deposition Microsystems Ionsys 500. Ion beam milling and ion beam deposition (Al). Sample size up to 150 mm diameter.

- Optical Maskless Lithography Durham Magneto Optics MicroWriter Ml. It is a flexible photolithography system designed for rapid prototyping and small volume manufacture in R&D laboratories and small clean rooms. Resolution up to 600 nm. 1 mm – 200 mm sample size. Up to 180 mm/minute writing speed.

- **Impact HD ESI-Q-TOF mass spectrometer** (Bruker). Impact HD is a Hybrid Quadrupole/Atmospheric Pressure Ionization orthogonal accelerated Time-Of-Flight mass spectrometer. This equipment sets the standard in ultra-high-resolution tandem mass spectrometry across a wide range of analytical applications. It ensures intact protein analysis and characterization of bio-pharmaceuticals, synthetic chemistry support, forensics and doping control, food products and many more. Samples can be introduced into API-electrospray ionization by syringe pump or liquid chromatographic system. The combination of LC (UltiMate 3000 LC System UHPLC+ Focused (Thermo Scientific/Dionex)) and MS allows detection of masses in complex matrices. The LC system is routinely run in connection with a high-resolution MS spectrometer, however, it is also equipped with its own, fast (200 Hz) diode-array detector.

- AB Sciex **QTRAP 6500 system SelexIon mass spectrometer** coupled with an Eksigent LC100 **UHPLC** system is a triple quadrupole mass spectrometer with a linear ion trap technology. It is designed for quantitative analysis featuring scan speeds of up to 20,000 Da/s for optimized UHPLC measurements and a mass range of up to 2000 m/z upper

mass limit. Additional unique features of the system include: MRM^3 workflows, peptide quantitation, targeted trace analysis of contaminants as well asgreat confidence in forensic toxicology applications. It is also equipped with a unique SelexION Differential IonMobility Technology designed for elimination of challenging co-eluting contaminants, and reduction of high background noise. Other mass spectrometers are also available at WCAT.

- **Maldi TOF/TOF** UltraflexXtreme (Bruker) mass spectrometer. The spectrometer offers ultrahigh performance and flexibility for a broad variety of complementary research, clinical and applied proteomics applications. The system is designed for high-throughput protein identification by MALDI-TOF peptide mass fingerprinting. The data can be readily searched through databases, allowing rapid identification of proteins, and further interpreted using the Biotools software suite. The system features up to 40,000 mass resolution and 1 ppm mass accuracy, high throughput analysis with 2 kHz laser and 384 well sample target. Possible applications include: routine peptide MW measurements, proteins up to 100 kDa, oligosaccharides, oligonucleotides, soluble proteins from microorganisms. Synthetic polymer analysis using Polytools software and more advanced Polymerix software package (Sierra Analytics)
- NexIon 300D **ICP-MS Spectrometers** (Inductively Coupled Plasma Mass Spectrometer) (Perkin Elmer inc.). The system is capable of detecting metals and several non-metals at concentrations as low as 1 ppb or even less. The technique offers great speed, precision, and sensitivity and can be used for both qualitative and quantitative approaches. Possible applications are in medical and forensic fields, toxicology, industrial and biological monitoring (metal analysis), radiometric dating, and more.
- Bruker Ascend™ **NMR 600 MHz** equipped with a 24 position SampleCase sample changer, sample cooling down to –50°C and CryoPlatform™ Prodigy probe. Other available probes allow NMr measurements in the range ^{19}F and ^{31}P-^{15}N, ^{1}H decoupling/observe, increased sensitivity for ^{1}H (tunable to ^{19}F) and ^{13}C Broadband Probe, 5 mm, 'BBFO SMArT probe' with ATM with the operating range 1^{9}F and ^{31}P-^{15}N, ^{1}H decoupling/observe, observation ^{19}F with ^{1}H decoupling and vice-versa, two-dimensional ^{1}H/^{19}F spectroscopy with superior quality VTN CP/MAS Probehead, rotor size 2,5 mm
- In addition, the WCAT also offers access to: **Thermal Analysis Lab, Infra-Red Spectroscopy Lab, X-ray Lab** and many other analytical possibilities.
- AMU CAT cooperates closely with the Faculty of Chemistry (located on campus, right next to the Center). The Faculty offers access to uniquely-equipped time-resolved spectroscopy laboratory with: nano- and femto-second **transient absorption laser spectrometers** (Spectra-Physics, Ultrafast Systems), picosecond **fluorescence lifetime spectrophotometer** (PicoQuantFT300) and **time-resolved confocal fluorescence microscope** (PicoQuant MT200). All the equipment will be available to the Dioscuri Center staff either directly or through our skilled technicians

10. List of the additional benefits (other than listed in call text) that the Institution declares to provide for the Dioscuri Centre

The staff of the future Dioscuri Center in Poznań will have access to a modern infrastructure and research equipment available at AMU CAT. Thanks to the access to our infrastructure and staff (from both Faculty of Chemistry and AMU CAT, both located next

to each other on the Morasko Campus in Poznan), the AMU-Dioscuri "consortium" will gain important factor for securing every-day activity and sustainable development.

Close proximity of Chemistry, Biology and Physics Faculty buildings (located on the same university campus) guarantees that the researchers employed at Dioscuri Center gain easy access not only to the state-of-the-art research equipment and professional technicians but also to outstanding researchers open for international cooperation. There are also numerous English language research seminars and conferences organized at AMU CAT and at the faculties.

Undoubtedly, the strength of AMU CAT is our modern infrastructure, well equipped laboratories and office space. The undisturbed access to AMU CAT infrastructure might be an additional benefit for candidates to Dioscuri program. The future Dioscuri Center staff will have a guaranteed access to all the research equipment and their skilled operators/technicians and a machine shop.

In addition to the excellent working environment offered at AMU CAT, the management of the Center follows general university policy that physical activity is essential for good health of employees.
WCAT workplace can also help increase physical activity levels, and thus offers a small, but well-equipped gym with treadmills for runners and walkers, compact rowing machines and weights.

As an additional offer, AMU-CAT declare the following:

1) provide from its own budget **additional funding** for the Dioscuri Centre in the amount of **€ 10 000 on average per year** for the entire funding period.
2) in addition to team members employed within the Dioscuri Centre from the project, AMU-CAT will fund the full-time position of the research technician, and will also provide stipends for two additional PhD students.
3) at the initial stage of the project, the AMU will provide the flat for the Dioscuri leader and his/her family. The AMU will also guide and help other team members to find proper accommodation.
4) guidance and help in finding suitable job offer for the spouse of the group leader will also be provided.
5) all member of the Dioscuri Centre will have the same rights and access to the University benefits for employees, including: e-sport card, University medical care as well as special medical bundles, University holiday centers etc.
6) An institutional mentor for the DC leader will be appointed. This person will guide the Leader during the first year of funding period through the regulations and working culture of AMU.
7) AMU Project Support Centre will provide assistance in project implementation and all project-related issues.

11) Other information about the internationalisation of the research institution, international researchers employed at the institution, the availability of English language seminars etc.

Adam Mickiewicz University, with its two leading institutes (Faculty of Chemistry and AMU CAT) has recently moved to the new Morasko Campus and thanks to the contribution from

EU-acquired funds for state-of-the-art research equipment. With these investments the university has ambitions to be not only a local leader in smart synthesis and photonics/spectroscopy-related research. This can be achieved by a close and efficient cooperation with world-leading institutions like Max Planck Institute or its international branch locations (Dioscuri Centers).

Adam Mickiewicz University in Poznan is the major academic institution in Poznan and the third largest university in Poland with nearly 3 000 teaching staff. The University was founded in 1919 and currently its student population is nearly 50 000 students.

The University is a center of academic excellence, where research and teaching are mutually sustaining. The University continuously extends and updates research programs and contents of study curricula, with special emphasis on their interdisciplinary and international nature in which AMU CAT plays a crucial role.

The mission of the University is to advance knowledge through high quality research and teaching in partnership with business, the professions, public services and other research and learning providers. In a recent decade our professors coordinated or were partners in tens of research projects funded by the European Union Framework Program for Research and Technological Development (FP5 – FP7/H2020). AMU is a member of numerous international organizations, e.g.: EUA - European University Association, EUCEN - European University Continuing Education Network, The Compostela Group of Universities, The Santander Group - European University Network, European Chemistry Thematic Network and other European Research Networks.

The AMU CAT International Advisory Board plays an important role in the Center's structure. This influential group of science leaders is composed of well-recognized leaders in the scientific world, e.g.: Prof. Krzysztof Matyjaszewski (USA), Prof. Michael Giersig (Germany), Prof. Jean-Marie Lehn (France), Prof. Walter Leitner (Germany), Prof. Ulrich Schubert (Austria), Prof. Arno Ehresmann (Germany) just to mention a few.