Registration form for Polish scientific institution

1. Scientific institution data (name and address):

Center for Advanced Technology, Adam Mickiewicz University, Poznań (AMU-CAT)
89C Umultowska Str.
61-614 Poznan, Poland
czt@amu.edu.pl

2. Type of scientific institution (select one out of 7 listed options):

7) university research centre established within a single university structure

3. Head of the institution:

Prof. Andrzej Lesicki
1 Wieniawskiego Str.
61-712 Poznan, Poland
rectorof@amu.edu.pl

4. Contact information of designated person(s) for applicants and NCN: first and last name, position, e-mail address, phone number, correspondence address):

Dr. Tomasz Pedzinski
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+48 507 356261

AMU Center for Advanced Technology
89C Umultowska Str.
61-614 Poznan, Poland

5. Science discipline in which strong international position of the institution ensures establishing a Dioscuri Centre (select one out of 25 listed disciplines):

Natural Sciences and Technology

☐ **Materials and synthesis**

6. Description of important research achievements from the selected discipline from the last 5 years including list of the most important publications, patents, other (*up to one page in A4 format*):

The Center for Advanced Technology (formerly known as Wielkopolska Center for Advanced Technologies, WCAT) is a newly established research and development center of Adam Mickiewicz University on Morasko Campus in Poznań, Poland. The Center has profound expertise in smart synthesis with a particular focus on organosilicon-based materials, i.e. those containing silsesquioxanes as a specific class of three-dimentional (Si-O-Si) frameworks and also highly π-conjugated systems. Their scientific and applied potential is reflected in hundreds of papers and patents from many branches of chemistry, physics as well as medicine due to their unique properties (e.g. oxidation resistance, dielectric as well as thermal, mechanical resistance and optical and photonic properties) that arise from their hybrid inorganic-organic nature. The presence and appropriate location of organic groups facilitates their further modification and synthesis of multifunctional derivatives and plays a decisive role in their application as nanofillers and modifiers to form nanostructured composites as well as ligands or catalysts supports. The crucial aspect of silsesquioxane synthesis is to introduce specific organic functional groups onto the scaffold applying both stoichiometric and/or catalytic procedures e.g. nucleophilic substitution, hydrosilylation, cross-metathesis as well as metallative coupling and other reactions including those discovered by the AMU CAT research team members. Current research on metallative coupling allowed to synthesize a wide spectrum of molecular and macromolecular unsaturated compounds containing silicon, germanium or boron in their structure as well as highly π-conjugated chromophores. Depending on the type of a metalloid(s) atom(s) present in the structure, the reaction conditions differ but enable efficient and successful synthesis of expected products. Photophysical properties (including absorption and emission characteristics) of silicon and germanium compounds were studied and compared with the suitable chromophores and model compounds. The intramolecular electron transfer that occurs in the silicon-bridged compounds from *N*-isopropylcarbazole to the divinylbenzene chromophore was successfully investigated and explained. We can also boast of great experience in the designing and synthesis of various organic/organosilicon ligands and their application in the preparation of coordination compounds of transition metals such as Fe, Ru, Co, Rh, Ni, including derivatives of heavy metals such as Pt, Ir. Recently, our research interests include topics related to the preparation of organometallic iridium(III) compound and use them as phosphorescent emitters-ingredients of phosphorescence composites which in further steps will be applied for the construction of organic light emitting diodes (OLED's). In this field, we are focused on the development of novel *N*-heteropolycyclic ligands, which unique structure and electronic properties make it possible to obtain a well-defined iridium(III) complexes exhibiting a high quantum yield of the luminescence in the desired wavelength range. Current research is focused on the design and synthesis of ligands, comprising functional groups permitting both n and p type conductivity, which will allow free energy transport from the polymer organic matrix to the iridium(III) phosphorescence emitter. It means that by the selection of functional groups that will be attached to the cyclometalated N-heterocyclic core and considering their stereoelectronic properties or/and by modification of ancillary ligands bonded to iridium center, we can obtain light emission of a desired color. Additionally, by the introduction to the main ligand core with steric or dendritic substituents we can prevent aggregation of the complex molecules in the organic matrix, increasing their electroluminescence properties by elimination of the so-called concentration quenching, so non-radiative energy conversion. Recent literature is presented below:

1. P. Żak, B. Dudziec, M. Kubicki, B. Marciniec *Chem. Eur. J*. 2014, 20, 9387–9393
2. M. Ludwiczak, M. Bayda, M. Dutkiewicz, D. Frąckowiak, M. Majchrzak, B. Marciniak, B. Marciniec *Organometallics* 2016, 35, 2454–246
3. P. Groch, K. Dziubek, K. Czaja, B. Dudziec, B. Marciniec *Eur. Polym. J*. 2017, 90, 368-382
4. S. Alexandris, A. Franczyk, G. Papamokos, B. Marciniec, R. Graf, K. Matyjaszewski, K. Koynov, G. Floudas *Macromolecules* 2017, 50, 4043-4053
5. P. Żak, B. Dudziec, B. Marciniec US 9,150,596 (B2) 2015
6. M. Bayda, G. Angulo, G. L. Hug, M. Ludwiczak, J. Karolczak, J. Koput, J. Dobkowski, B. Marciniak B. *Phys Chem Chem Phys*. 2017, 19(18), 11404-11415
7. B. Orwat, E. Witkowska, I. Kownacki, M.-J. Oh, M. Hoffmann, M. Kubicki, I. Grzelak, B. Marciniec, I. Glowacki, B. Luszczynska, G. Wiosna-Salyga, J. Ulanski, P. Ledwond, M. Lapkowski *Dalton Trans*. 2017, *46*, 9210–9226
8. B. Marciniec, H. Maciejewski, P. Pawluć Hydrosilylation of Carbon-Carbon Multiple Bonds – Application in Synthesis and Materials Science, (ed. Vladimir Ya Lee), Elsevier, 2017
9. C. Pietraszuk, P. Pawluć, B. Marciniec Metathesis of Silicon-Containing Olefins, Chap.9 in Handbook of Metathesis (Second Edition), R. H. Grubbs, D. J. O'Leary, Eds; VCH-Wiley Weinheim, 2015, 2, 583-631
10. M. Bayda, M. Ludwiczak, G. L. Hug, M. Majchrzak, B. Marciniec, B. Marciniak *J. Phys. Chem. A*, 2014, 118, 4750-4758
11. A.Franczyk, H. He, J. Burdyńska, Ch. Hui, K. Matyjaszewski, B. Marciniec *ACS Macro Lett.*, 2014, *3* (8), pp 799–802
12. C. Pietraszuk, P. Pawluć, B. Marciniec Handbook on Metathesis, 2015, 2, 9, 583-631
13. D. Frąckowiak, P. Żak, G. Spólnik, M. Pyziak, B. Marciniec *Organometallics*, 2015, 34, 3950-3958
14. S. Alexandris, A. Franczyk, G. Papamokos, B. Marciniec, K. Matyjaszewski, K. Koynov, M. Mezger, G. Floudas *Macromolecules*, 2015, *48*, 3376–3385

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 MAESTRO: "*Inorganometallic catalysis - new strategy for synthesis of organometallic reagents, polymers and nanomaterials*" UMO-2011/02/A/ST5/00472
   Principal Inverstigator – Prof. Bogdan Marciniec
   National Science Centre, Poland
   Amount of Funding: 2 400 000 PLN

2. Project SONATA BIS: "*New (supramolecular) approach to two-dimensional layered materials*" UMO-2015/18/E/ST5/00188
   Principal Inverstigator – dr Artur Ciesielski
   National Science Centre, Poland
   Amount of Funding: 1 476 740 PLN

3. Project OPUS 6: "*New phosphorescence emitters for organic electroluminescent diodes*" UMO-2013/11/B/ST5/01334
   Principal Inverstigator – Dr. Ireneusz Kownacki
   National Science Centre, Poland
   Amount of Funding: 1 460 440 PLN

8. Description of the available laboratory and office space for Dioscuri Centre (*up to one page in A4 format*):

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 scientific equipment for 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) massspectrometer. 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 that the Institution declares to provide for Dioscuri Centre (i.e.: additional funds, personal benefits, other) (*up to one in page A4 format*):

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.

As a benefit for a Dioscuri Center located at AMU CAT the university declares annual donation of at least EUR 25k to be at the disposal of future Dioscuri Center director. In addition to that, the university declares to fully cover the salary of one English speaking administration employee. This person will be employed by the university and delegated solely to work for the Dioscuri Center.

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.

11. Other information about internationalization of the scientific institution, foreign scientists employed at the institution, availability of the English language seminars etc. (*up to one page in A4 format*):

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.