Prospective supervisor's form

Name of the supervisor: Anna Lisowska-Oleksiak

Academic title: Professor

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Faculty of Faculty of Chemistry

Gdańsk University of Technology **Department of** Department of Chemistry and Technology of Functional Materia

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Discipline[i] chemical sciences [NCh] materials engineering [IMa]

Optional

Key words (obligatory four key words describing research interests / expertise):

Electrochemistry

energy storage and conversion

Photoelectrocatalysis

biomass derived electrode materials

Bibliometric indicators

1. Number of journal publications in WoS/ Scopus 90/93
2. Citations excluding self-citations WoS 910 Scopus 910
3. Hirsch index WoS 20 Scopus 19

1. The number of PhD students who have graduated under your supervision: 6
2. The number of PhD students currently supervised:
   a. within the current doctoral school 0
   b. within doctoral studies (previous system 6
3. Are you currently accepting new PhD students:
   a. Polish *Yes/No* Yes
   b. Foreign *Yes/No* Yes

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Research interests or topics offered for PhD research (no more than 2000 characters)[ii]

Main research interest is placed in the field of ELECTROCHEMISTRY directed towards ENERGY STORAGE AND CONVERSION DEVICES (ECSDs). Electrochemistry of ECSDs nowadays is seen as food soldiers indispensable to combat fossil fuels use in energy production. New renewable energy sources, like wind power stations, solar panels, require energy storage systems like batteries or supercapacitors. Electrochemistry can offer renewable fuel: hydrogen from water, obtained via photoelectrocatalysis. In this broad domain research activity is focused on 3 particular projects: 1) high energy secondary batteries (Li-ion LIBs, Na –ion SIBs), including both anode and cathode electrodes materials, taking advantage of nanotechnology. In this field studies on two dimensional (2-D) oxides as electroactive species are in the main objectives with respect to cathodic materials. Sodium-ion batteries have attracted attention due to the abundance of sodium natural resources. Both anode and cathode materials in 2-D nano-size dimension particulates of electroactive species are shown promising due to shortened pathfor ion transportation and larger surface area for ions (Na+, Li+) electrosorption. 2) Supercapacitors with hybrid electrodes combining 2D nanomaterials and Nature originated nanomaterials are planned for the novel electrode design - for example biomass reach with nano-silica from diatoms, carbon black from Hemp and other celulose reach natural resources substates.
3) Hybrid devices combing pseudocapacitive and faradaic performance, suitable for electrochemical capacitors and photocapacitors. The pseudo-faradaic activity of dichalcogenides/intercalation studies is planned.
semiconductor electrode materials active in electrochemical water splitting. In this project, research is focused on semiconductor electrodes active as anodes under sunlight illumination. The focus is on the relation between photointercalation phenomena and photoactivity of the matterial.

Funding or special equipment needed to carry out a PhD project[iii]:

1. Is funding available for experimental work: *Yes/No/not needed* — Yes
2. Is the equipment needed to complete a PhD project available in your lab/department: *Yes/No/not needed* — Yes

Most important publications – no more than 5 published after 1.01.2018

No	Authors/title/journal	Number of points according to the current list of the Ministry of Science and Higher Education	Publication year
1.	A. P. Nowak, K. Trzciński, M. Sprynskyy, J. Wysocka,Szkoda, B. Buszewski, A. Lisowska-Oleksiak, Diatoms Biomass as a Joint Source of Biosilica and Carbon for Lithium-Ion Battery Anodes. Materials 13 (7) 2020 1673, doi:10.3390/ma13071673.	140	2020
2.	AP Nowak, M Sprynskyy, W Brzozowska, A.Lisowska-Oleksiak, Electrochemical behavior of a composite material containing 3D-structured diatom biosilica - Algal Research, 41 (2019) 101538	100	2019

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3.	Mariusz Szkoda, Konrad Trzciński, AP Nowak, Emerson Coy, Leszek Wicikowski, Marcin Łapiński, Katarzyna Siuzdak, Anna Lisowska-Oleksiak, Titania nanotubes modified by a pyrolyzed metal-organic framework with zero valent iron centers as a photoanode with enhanced photoelectrochemical, photocatalytical	100	2018
4.	Konrad Trzciński, Mariusz Szkoda, Kamil Szulc, Mirosław Sawczak, Anna Lisowska-Oleksiak, The bismuth vanadate thin layers modified by cobalt hexacyanocobaltate as visible-light active photoanodes for photoelectrochemical water oxidation, Electrochim Acta,295 (2019)	100	2019
5.	Konrad Trzciński, Mariusz Szkoda, Andrzej P Nowak, Marcin Łapiński, Anna Lisowska-Oleksiak, Widening of the electroactivity potential range by composite formation–capacitive properties of TiO2/BiVO4/PEDOT: PSS electrodes in contact with an aqueous electrolyte, Beilstein journal of nanotechnology, 10 (2019) 483-493.	100	2019

Most recent externally funded projects you were involved in – no more than 3

No	Project title, the name of the Principal Investigator (PI) and the institution the project was carried out	Years	Role in the project [iv]
1.	Synthesis and characterization of photoelectroactive molybdenum oxide layers obtained by electrochemical molybdenum anodization. 2016/23/N/ST5/02071 /Gdańsk Univeristhy of Technology	2017-2019	Co-I
2.			R
3.			PI

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Additional relevant information – (no more than 1600 characters)[v]

Studies devoted to energy storage and conversion devices are combining chemistry, electrochemistry, nanotechnology and material sciences. Candidates may have a Master degree in chemistry or physics and material engineering. Among my previous Ph.D. students, 90 % received a diploma with honors. Currently, Dr Mariusz Szkoda, who defended his PhD thesis in 2018, is running a project started in 2020, in which part of the studies is strictly related to the proposed research and will be done in collaboration with Dr Mariusz Szkoda.
Currently running project as Statutory research (DS) on Functional Materials for Energy Storage and Conversion Devices under my supervision are:
1) Biosilica from diatoms for lithium-ion batteries
2) Biomass from agriculture resources (e.g. hemp straw) for porous carbonaceous electrode matterial.
3) Transition metals oxides of 2-D structure for photoelectrocatalysis and supercapacitors.

[i] You may select up to two disciplines out of 12 disciplines represented in the Doctoral School
[ii] Observe the limit of not more than 2000 characters
[iii] Leave only one answer
[iv] Select the role in the project: PI stands for principal investigator (refers to the holder of an independent grant and the lead researcher for the grant project), Co-I for co-investigator (Co-I assists the principal investigator in the management and leadership of the research project), R for researcher
[v] Add any other relevant information e.g. awards for PhD students whom you supervised (no more than 1600 characters)