Prospective supervisor's form

Personal data

The prospective supervisor's name: dr hab. inż. Justyna Łuczak
Employment: Faculty of Chemistry, Department of Process Engineering and Chemical Technology
Phone: +48(58) 347 13 65
E-mail address: justyna.luczak@pg.edu.pl
Personal web page: http://pg.edu.pl/web/920e71bf9e_justyna.luczak
ORCID number: 0000-0001-9939-7156

Research interests

Discipline: Chemical sciences
Research area: Chemical Technology
Additional research area: Environmental Science
Key words: colloid and surface chemistry, ionic liquids, nano- and microstructures, photocatalysis

Research interests or topics offered for PhD research

One of the research interest is related with development of novel ionic liquids (ILs), with improved sustainability, derived from the chemical processing of natural, abundant materials like lignocellulosic biomass. The concept of the idea combines two contemporary trends in modern chemistry, i.e. the use of biocomponents produced in biorefinery processes and the synthesis of new classes of bio-based, multifunctional ILs. The sustainable new bio-ILs will have numerous functionalities - surface, antimicrobial and catalytic activity. In addition, new cations will be combined with other bio-derived moieties (e.g. fatty acids) and synthetized as polymeric, antimicrobial surfaces. In that manner, the range of possible functionalities increases. Functionality and environmental hazard of biomass-derived ionic liquids will be also assessed. The another research idea is related with development of new highly porous functional materials in the form of metal organic frameworks (MOFs) modified with amino acid-derived ionic liquids. MOFs are primarily characterized by high stability, ultra-high surface area and very high porosity. Hence, one of the potential applications of MOFs is the separation of CO2 from gaseous streams due to the ability to create MOFs with different pore sizes and shapes, and a favorable topology for CO2 capture. Ionic liquids, in turn, are new generation of solvents alternative to amines currently used in CO2 absorption. In this regard, proper selection of porous MOFs and its functionalization by CO2 absorbents can increase CO2 sorption capacity and sorption selectivity in the CO2/CH4 system. The materials will be designed so that: (i) they have a high sorption capacity for CO2 and high selectivity in the separation of CO2 from streams containing CH4, N2 and H2S; (ii) high capacity for regeneration and recovery of stored CO2, (iii) the possibility of multiple use, and (iv) the cost of their production and regeneration (CO2 recovery) was relatively low.

Supervision

The number of PhD students who have graduated under the prospective supervisor’s supervision: 2
The number of PhD students currently supervised - within the current doctoral school: 1
The number of PhD students currently supervised - within doctoral studies (previous system): 2
Currently accepting new PhD students: Polish and foreign
Funding and equipment

Is funding available for experimental work? No
Is the equipment needed to complete a PhD project available in your lab/department? Yes

Bibliometric indicators

- Number of journal publications in WoS/Scopus: 57
- Citations (excluding self-citations) - WoS: 1401
- Citations (excluding self-citations) - Scopus: 1443
- Hirsch index - WoS: 17
- Hirsch index - Scopus: 17

List of the selected key publications

Visible-light-driven lanthanide-organic-frameworks modified TiO2 photocatalysts utilizing up-conversion effect

Klimczuk T., Łuczak J., Lisowski W., Parnicka P., Zaleska-Medynska A., Żak A. - APPLIED CATALYSIS B-ENVIRONMENTAL
Journal article / In the printed version (also digital), Publication year: 2021, Points: 200.0
https://dx.doi.org/10.1016/j.apcatb.2021.120056

Synergy between AgInS2 quantum dots and ZnO nanopyrramids for photocatalytic hydrogen evolution and phenol degradation

Journal article / In the printed version (also digital), Publication year: 2020, Points: 200.0
https://dx.doi.org/10.1016/j.jhazmat.2020.123250

How thermal stability of ionic liquids leads to more efficient TiO2-based nanophotocatalysts: Theoretical and experimental studies

Journal article / In the printed version (also digital), Publication year: 2020, Points: 100.0
https://dx.doi.org/10.1016/j.jcis.2020.03.079

The effect of imidazolium ionic liquid on the morphology of Pt nanoparticles deposited on the surface of SrTiO3 and photoactivity of Pt–SrTiO3 composite in the H2 generation reaction

Journal article / In the printed version (also digital), Publication year: 2019, Points: 140.0
https://dx.doi.org/10.1016/j.ijhydene.2019.08.094

Ordered TiO2 nanotubes with improved photoactivity through self-organizing anodization with the addition of an ionic liquid: effects of the preparation conditions

Łuczak J., Pancielejko A., Mazierski P., Lisowski W., Zaleska-Medynska A. - ACS Sustainable Chemistry & Engineering
Journal article / In the printed version (also digital), Publication year: 2019, Points: 140.0
https://dx.doi.org/10.1021/acssuschemeng.9b03589
Most recent projects

New semiconductor materials for photocatalytic hydrogen generation: formation mechanism in the presence of ionic liquids

Principal Investigator (PI) name: dr inż. Ewelina Grabowska
Name of the institution the project was carried out in: Gdańsk University of Technology
Name of the granting institution: Narodowe Centrum Nauki (NCN)
Starting year: 2018
Ending year: 2021
Role in project: Co-Investigator (Co-I)

Effect of ionic liquid structure on interactions with TiO2 particles in hydrothermal synthesis

Principal Investigator (PI) name: dr hab. inż. Justna Łuczak
Name of the institution the project was carried out in: Gdańsk University of Technology
Name of the granting institution: Narodowe Centrum Nauki (NCN)
Starting year: 2015
Ending year: 2018
Role in project: Principal Investigator (PI)

Aggregation of nonionic surface active agents in ionic liquids

Principal Investigator (PI) name: dr hab. inż. Justna Łuczak
Name of the institution the project was carried out in: Gdańsk University of Technology
Name of the granting institution: Narodowe Centrum Nauki (NCN)
Starting year: 2013
Ending year: 2015
Role in project: Principal Investigator (PI)

Additional information

Anna Pancielejko: • Scholarship from the InterPhD2 program 'The development of interdisciplinary doctoral studied with an international dimension', project co-financed by the European Union under the European Social Fund - Operational Program Knowledge Education Development (POWER), 2018/2019 • Scholarship from the InterPhD2 program 'Development of an interdisciplinary program of doctoral studies with an international dimension', project co-financed by the European Union under the European Social Fund - Operational Program Knowledge Education Development (POWER), 2019/2020 • Pro-quality scholarship, 2019/2020 • Rector's scholarship for the best doctoral students, 2019/2020 • Scholarship from the 'Integrated Development Program of the Gdansk University of Technology POWR.O3.05.0a-00-ZOUl17', project co-financed from European Funds, 2020/2021 Marta Paszkiewicz-Gawron - Team Rector's Award for a series of international scientific articles and an international book on preparation and characterization of functional nanomaterials using experimental methods (UG) - Honorable mention status of doctoral dissertation "Surface and photocatalytic properties of TiO2 particles modified with ionic liquids" 2018 - Rector's scholarship for the best PhD students at UG 2015/2016; 2016/2017