



**University of Warsaw  
Faculty of Chemistry**

dr Anna Maria Nowicka

***Electrochemical DNA biosensors  
– multitask tools for analytical  
and physicochemical purposes***

Elaboration on scientific and other academic achievements on account  
of application for the degree of doctor of habilitation

Warsaw, 2013



## *Contents*

<b>1. PERSONAL DATA</b> .....	5
<b>2. INFORMATION ON RECEIVED DIPLOMAS AND SCIENTIFIC DEGREES</b> .....	5
<b>3. INFORMATION OF EMPLOYMENT IN SCIENTIFIC INSTITUTIONS</b> .....	5
<b>4. INDICATION OF ACHIEVEMENTS ACCORDING TO ART. 16 PARAGRAPH 2 OF THE ACT OF LAWS FROM 14 MARCH 2003 ON ACADEMIC DEGREES (JOURNAL OF LAWS NO. 65, ITEM 595 AS AMENDED) THAT CAN BE TREATED AS BASIS FOR HABILITATION PROCEDURE</b> .....	6
4.1. Title of achievement .....	6
4.2. Subject-specific set of papers published in journals listed by Journal of Citation Reports .....	6
4.3. Indication of scientific aim and discussion of most significant results .....	8
4.4. Summary .....	8
<b>5. DESCRIPTION OF OTHER SCIENTIFIC ACHIEVEMENTS</b> .....	9
5.1. Summary of scientific output .....	9
5.2. List of Journal-Citations-Reports papers (except for those listed in section 4) published before getting doctor degree .....	10
5.3. List of Journal-Citations-Reports papers (except for those listed in section 4) published after getting doctor degree .....	11
5.4. Summary of scientific activity related to papers listed in section 5.3 .....	17
<b>6. INFORMATION ON OTHER ACTIVITIES</b> .....	19
6.1. Teaching activities.....	19
6.2. Scientific care over students .....	20
6.3. Engagement in scientific projects.....	21
6.4. Scientific visits in other scientific and academic centers .....	22
6.5. Scientific awards / prizes.....	22

6.6. Participation in local and international scientific conferences .....	22
6.7. Reviewer for scientific agencies and scientific journal .....	28

## 1. PERSONAL DATA

**First name and last name:** Anna Maria Nowicka

**Date and place of birth:** 08.12.1976 Maków Mazowiecki

**Employer:** Faculty of Chemistry, University of Warsaw

PL-02-093 Warsaw, 1Pasteura Str.

**Scientific degree:** PhD in Chemistry

**Work phone:** 22-822-02-11 ext. 287

**E-mail:** anowicka@chem.uw.edu.pl

**Nationality:** Poland

## 2. INFORMATION ON RECEIVED DIPLOMAS AND SCIENTIFIC DEGREES

- PhD in Chemistry, defense with distinction, University of Warsaw, June 8, 2005.  
Title of PhD thesis: „Metalocene derivatives as model compounds for examination of diffusional, migrational and convectional transport”.  
Adviser: prof. dr hab. Zbigniew Stojek
- MSc in chemistry, defense with distinction, University of Warsaw, May 20, 2000.  
Title of MSc thesis: „Diffusional and migrational transport of monosubstituted ferrocene derivatives”.  
Adviser: prof. dr hab. Zbigniew Stojek

## 3. INFORMATION OF EMPLOYMENT IN SCIENTIFIC INSTITUTIONS

Adjunkt, University of Warsaw, Faculty of Chemistry, Laboratory of Theory and Applications of Electrodes, from 2005

*Anna M. Nowicka*

**4. INDICATION OF ACHIEVEMENTS ACCORDING TO ART. 16  
PARAGRAPH 2 OF THE ACT OF LAWS FROM 14 MARCH 2003 ON  
ACADEMIC DEGREES (JOURNAL OF LAWS NO. 65, ITEM 595 AS  
AMENDED) THAT CAN BE TREATED AS BASIS FOR  
HABILITATION PROCEDURE**

**4.1. Title of achievement**

Electrochemical DNA biosensors – multitask tools for analytical and physicochemical purposes

**4.2. Subject-specific set of papers published in journals listed by Journal of Citation Reports**

(\* – candidate is corresponding author)

- H1. A.M. Nowicka, A. Kowalczyk, Z. Stojek, M. Hepel; „Nanogravimetric and voltammetric DNA-hybridization biosensors for studies of DNA damage by common toxicants and pollutants.” *Biophys. Chem.* 146 (2010) 42-53.

IF = 2.283

My contribution: 55 %; I have planned and overseen the experiments related to the DNA biosensors with gravimetric and electrochemical detection and to the influence of the presence of various forms of chromium on their work. I have synthesized streptavidin modified ferrocene and written the first draft of the paper. I have also edited the replies to comments of the reviewers.

- H2. A. Kowalczyk, A.M. Nowicka, R. Jurczakowski, P. Niedzialkowski, T. Ossowski, Z. Stojek; „New anthraquinone derivatives as electrochemical redox indicators for the visualization of the DNA hybridization process.” *Electroanalysis* 22 (2010) 49-59.

IF = 2.721

My contribution: 40%. I have planned and overseen the experiments related to the estimation of the usefulness of new anthraquinone derivatives for visualization of the hybridization process. I have also done the preliminary experiments, interpreted the results, written the publication and edited the answers to reviewers' comments.

- H3. A.M. Nowicka\*, A. Kowalczyk, M. Donten, D. Leech, M. Hepel, Z. Stojek; „Substantial influence of temperature on anchoring of gold-nanoparticle monolayer for performance of DNA biosensors.” *Electroanalysis* 22 (2010) 2323-2329.

IF = 2.721

My contribution: 50 %. I have made the investigation plan and supervised the experiments. I have performed the experiments related to modification of electrode surface with colloidal gold, analysed the results, written the ms. corresponded with the editor and edited the replies to reviewers' comments.

- H4. A. Kowalczyk, A.M. Nowicka<sup>\*</sup>, R. Jurczakowski, M. Fau, A. Krolikowska, Z. Stojek; „Construction of DNA biosensor at glassy carbon surface modified with 4-aminoethylbenzenediazonium salt.” *Biosens. Bioelectron.* 26 (2011) 2506-2512.

IF = 5.437

My contribution: 45 %. I have planned and supervised the experiments. AFM measurements and impedance measurements with oligonucleotides with mismatching bases have been done by me. I have also analysed the results, written the ms. and edited the replies to reviewers' comments.

- H5. A.M. Nowicka<sup>\*</sup>, A. Kowalczyk, F. Scholz, Z. Stojek; „Changes in performance of DNA biosensor caused by hydroxyl radicals.” *Electroanalysis* 23 (2011) 55-62.

IF = 2.721

My contribution: 75 %. I have planned and overseen the investigations reported in this paper. I have done impedance measurements and analysed them. I have also written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- H6. M. Fau, A. Kowalczyk, P. Olejnik, A.M. Nowicka<sup>\*</sup>; „Tight and uniform layer of covalently bound aminoethylphenyl groups perpendicular to gold surface for attachment of biomolecules.” *Anal. Chem.* 83 (2011) 9281-9288.

IF = 5.695

My contribution: 75 %. I have planned and overseen the investigations reported in this paper. I have done EQCM measurements and taken AFM micrographs. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- H7. A. Kowalczyk, M. Fau, A.M. Nowicka, Z. Stojek; „Formation of intermediate layers for immobilization of biomacromolecules by self-assembling and reduction of phenyldiazonium salts. A comparative study.” *Electroanalysis* 24 (2012) 2053-2060.

IF = 2.721

My contribution: 40 %. I have planned and overseen the investigations reported in this paper. I have done impedance measurements and taken AFM micrographs. I have also analysed the results, corrected the ms., and edited the replies to reviewers' suggestions and comments.

- H8. A.M. Nowicka<sup>\*</sup>, A. Kowalczyk, S. Sek, Z. Stojek; „Oxidation of DNA followed by conformational change after OH radical attack.” *Anal. Chem.* 85 (2013) 355-361.

IF = 5.695

My contribution: 60 %. I have planned and overseen the investigations reported in this paper. I have done CD and EQCM measurements and analysed the results. I have also written the ms. and edited the replies to reviewers' suggestions and comments.

- H9. A.M. Nowicka<sup>\*</sup>, M. Fau, A. Kowalczyk, M. Strawski, Z. Stojek; „Electrografting of carboxyphenyl thin layer onto gold for DNA and enzyme immobilization.” *Electrochim. Acta*, <http://dx.doi.org/10.1016/j.electacta.2013.07.135>.

IF = 3.777

My contribution: 55 %. I have planned and overseen the investigations reported in this paper. I have done impedance measurements and prepared the samples for taking AFM micrographs. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

H10. A.M. Nowicka\*, M. Donten, Z. Stojek; „Repeated rearrangements of nucleotides immobilized on gold surface caused by UV irradiation in presence of dissolved oxygen.” *Electrochim. Acta* 110 (2013) 133-138.

IF = 3.777

My contribution: 80 %. I have done all voltammetric and spectroscopic measurements reported in this paper. I have took part in the analysis of the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

H11. A.M. Nowicka\*, M. Mackiewicz, E. Matysiak, B. Krasnodebska-Ostrega, Z. Stojek; „Voltammetric and electrochemical gravimetric selective detection of interactions between Tl(I) and guanine and the influence on activity of DNA drug-intercalators.” *Talanta* 106 (2013) 85-91.

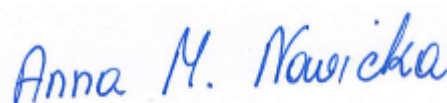
IF = 3.498

My contribution: 75 %. I have planned and overseen the investigations reported in this paper. I have done all gravimetric and CD measurements and analysed the results. I have written the ms., corresponded with the editor and edited the replies to reviewers' comments.

H12. A.M. Nowicka, Z. Stojek, M. Hepel; „Chromium(VI) but not chromium(III) species decrease mitoxantrone affinity to DNA.” *J. Phys. Chem. B* 117 (2013) 1021-1030.

IF = 3.607

My contribution: 80 %. I have planned and done all measurements reported in this paper. I have analysed the results and written the draft of the paper.



#### 4.3. Indication of scientific aim and discussion of most significant results

*Attachment no. 1*

#### 4.4. Summary

The set of selected papers presents the following issues:

- influence of the way of immobilization of single DNA strands (oligonucleotide probes) taken from bacteria *Listeria monocytogenes* and from the milk bacteria (strain: *Lactococcus lactis*) – on the quality of the sensing layer in the DNA biosensor;
- dependence of the efficiency of the hybridization process on the way of arrangement of the DNA strands in the sensing layer;
- monitoring of the DNA damages and the DNA transformation caused by reactive oxygen species and selected toxicants;
- comparison of sensitivity of DNA sensors coupled with various detection procedures;



- tagging the DNA biosensor for the purpose of visualization of the hybridization process;
- influence of the presence and concentration of reactive oxygen species on the performance of DNA sensors.

The experiments involved several independent techniques and this allowed me to draw several conclusions:

- stability and good quality of the sensor layers guarantees a satisfactory work of the DNA biosensors;
- the most uniform sensing layer with optimal density of the DNA strands can be obtained when the intermediate phenyl layers are formed by the way of appropriate electroreduction of a diazonium salt;
- the better quality of the phenyl intermediate layers compared to the thiol layers is a result of the way of binding of these layers with the substrate and their stable orientation vs. the substrate surface;
- modification of the gold surface with a layer of colloidal gold can widen the working concentration range of any DNA biosensor and improve its detection limit by at least one order of magnitude;
- electrochemical quartz microbalance and electrochemical faradaic impedance allow to detect the hybridization process without necessity of labeling the DNA biosensor with a redox probe; the condition is that the formation of the sensing layers is done with very good reproducibility;
- electrochemical DNA biosensors pass very well the competency tests, which opens real chances for their application;
- DNA biosensors appeared to be a useful tool in the examination of properties and activity of DNA under various conditions.

*Anna M. Nawicka*

## **5. DESCRIPTION OF OTHER SCIENTIFIC ACHIEVEMENTS**

### **5.1. Summary of scientific output**

Total number of publications: 42

List of scientific papers published after the doctor: 36

Total IF: 168.614

Report of citations according to the Web of Science (WoS 13.11.2013; publications H9, H10, D22, D23 and D24 accepted for publication are not indexed)

Total number of citations = 197 (5.32 citations / publication)

Total number of citation without self-citations = 129 (3.5 citations / publication)

Hirsch index H = 8

Anna M. Nowicka

## 5.2. List of Journal-Citations-Reports papers (except for those listed in section 4) published before getting doctor degree

M1. W. Hyk, A.M. Nowicka, Z. Stojek; „Direct determination of diffusion coefficient of substrate and product by chronoamperometric techniques at microelectrodes for any level of ionic support.” *Anal. Chem.* 74 (2002) 149-157.

IF: 5.695

My contribution: 10 %. I have performed electrochemical experiments.

M2. A.M. Nowicka, Z. Stojek, M. Ciszowska; „Voltammetric and spectroscopic studies of charged and uncharged diferrocene derivatives at regular and low ionic strength solutions.” *Anal. Let.* 37 (2004) 979-994.

IF: 0.965

My contribution: 50 %. I have performed all experiments and synthesised diferrocene derivatives. I have also analysed the results and written the first version of ms..

M3. A.M. Nowicka, W. Hyk, Z. Stojek, M. Ciszowska; „Parallel electrode processes in absence of supporting electrolyte. Further strong enhancement or depression of transport of ionic species.” *Pol. J. Chem.* 78 (2004) 1553-1565.

IF: 0.393

My contribution: 10 %. I have performed electrochemical experiments.

M4. W. Hyk, A.M. Nowicka, B. Misterkiewicz, Z. Stojek; „The extreme migrational enhancement of faradaic current at microelectrodes: experimental studies on sodium ( $\pm$ )-(6,8-diferrocenylmethylthio)octanoate electrooxidation.” *J. Electroanal. Chem.* 575 (2005) 321-328.

IF: 2.672

My contribution: 10 %. I have performed electrochemical experiments.

- M5. A.M. Nowicka, M. Donten, M. Pałys, Z. Stojek; „Effect of change in angle between microelectrode surface and jet direction in flow system on current response in solutions of different ionic strength.” *Anal. Chem.* 77 (2005) 5174-5181.

IF: 5.695

My contribution: 40 %. I have performed all experiments and synthesised ferrocene derivatives.

- M6. A.M. Nowicka, M. Donten, M. Pałys, B. Van den Bossche, Z. Stojek; „Voltammetric studies of parallel electrode processes in wall-tube cell under low ionic strength conditions.” *Electroanalysis* 18 (2006) 641-648.

IF: 2.721

My contribution: 35 %. I have performed all experiments and synthesised ferrocene derivatives.

*Anna M. Nowicka*

### 5.3. List of Journal-Citations-Reports papers (except for those listed in section 4) published after getting doctor degree

(\* – candidate is corresponding author)

- D1. A.M. Nowicka, E. Zabost, M. Donten, Z. Mazerska, Z. Stojek; „Electrooxidation of dissolved dsDNA backed by *in situ* UV-Vis spectroscopy.” *Bioelectrochem.* 70 (2007) 440-445.

IF: 3.947

My contribution: 40 %. I have performed all electrochemical experiments. I have also analysed the results and written the draft of ms..

- D2. A.M. Nowicka, E. Zabost, M. Donten, Z. Mazerska, Z. Stojek; „Spectroelectroanalytical properties of antitumor agent C-1311.” *Electroanalysis* 19 (2007) 214-219.

IF: 2.721

My contribution: 35 %. I have performed all electrochemical experiments. I have also analysed the results and written the draft of ms..

- D3. A.M. Nowicka<sup>\*</sup>, E. Zabost, M. Donten, Z. Mazerska, Z. Stojek; „Electrochemical and spectroscopic procedures for examination of interactions between double

stranded DNA and intercalating drugs.” *Anal. Bioanal. Chem.* 389 (2007) 1931-1940.

IF: 3.659

My contribution: 45 %. I have performed all electrochemical experiments. I have also analysed the results, determined the binding parameters between potential anticancer drug C-1311 and DNA. I have also analysed the results, written the draft of ms., corresponded with the editor and edited the replies to reviewers' comments.

- D4. M. Donten, A.M. Nowicka, M. Palys, J. Szydłowska, Z. Stojek; „Voltammetry of undiluted red-ox systems. Electrochemical ESR and electrochemical impedance spectroscopy evidence for formation of ionic liquid at microelectrode surface.” *Electroanalysis* 20 (2008) 9-13.

IF: 2.721

My contribution: 15 %. I have performed all electrochemical experiments.

- D5. A. Kowalczyk, A.M. Nowicka\*, M. Karbarz, Z. Stojek; „Thermoresponsive polymeric gel as a medium for examination of interactions between dsDNA and anticancer drug.” *Anal. Bioanal. Chem.* 392 (2008) 463-469.

IF: 3.659

My contribution: 40 %. I have planned and overseen the investigations reported in this paper. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D6. J. Hajdukiewicz, S. Boland, P. Kavanagh, A.M. Nowicka, Z. Stojek, D. Leech; „Enzyme-amplified amperometric detection of DNA using redox mediating films on gold microelectrodes.” *Electroanalysis* 21 (2009) 342-350.

IF: 2.721

My contribution: 10 %. I have performed the experiments on the stability of the DNA biosensor.

- D7. A.M. Nowicka\*, E. Zabost, B. Klim, Z. Mazerska, Z. Stojek; „Interactions of dissolved dsDNA with intercalating drug by anodic voltammetry and spectroscopy. Influence of pH.” *Electroanalysis* 21 (2009) 52-60.

IF: 2.721

My contribution: 30 %. I have planned and overseen the investigations reported in this paper. I have performed the part of the electrochemical measurements. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D8. E. Zabost, A.M. Nowicka, M. Donten, Z. Stojek; „Substantial difference between temperature dependencies of dsDNA predenaturation process obtained by voltammetry and spectroscopy.” *Phys. Chem. Chem. Phys.* 11 (2009) 8933-8938.

IF: 3.829

My contribution: 10 %. I have performed the part of the electrochemical measurements.

- D9. A.M. Nowicka<sup>\*</sup>, A. Kowalczyk, M. Donten, P. Krysinski, Z. Stojek; „Influence of a magnetic nanoparticle as a drug carrier on the activity of anticancer drugs: interactions of double stranded DNA and doxorubicin modified with a carrier.” *Anal. Chem.* 81 (2009) 7474-7483.

IF: 5.695

My contribution: 30 %. I have planned and overseen the investigations reported in this paper. I have performed the part of the electrochemical measurements. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D10. A.M. Nowicka, S. Hafner, M. Hepel; „Antineoplastic drug interactions with DNA modified gold piezoelectrodes.” 2009 volume 19 ECS Transactions book (Dielectric and Engineered Interfaces in Biological and Biomedical Applications).

My contribution: 10 %. I have performed the part of the electrochemical measurements.

- D11. A.M. Nowicka<sup>\*</sup>, U. Hasse, M. Hermes, F. Scholz; „Hydroxyl radicals attack metallic gold.” *Angew. Chem. Int. Ed.* 49 (2010) 1061-1063.

IF: 13.455

My contribution: 70 %. I have putted the research problem, planned and overseen the investigations reported in this paper. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D12. A.M. Nowicka<sup>\*</sup>, U. Hasse, G. Sievers, M. Donten, Z. Stojek, S. Fletcher, F. Scholz; „Selective knockout of gold active sites.” *Angew. Chem. Int. Ed.* 49 (2010) 3006-3009.

IF: 13.455

My contribution: 50 %. I have planned and overseen the investigations reported in this paper. I have performed the part of the electrochemical measurements. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D13. T. Rapecki, A.M. Nowicka, M. Donten, F. Scholz, Z. Stojek; „Activity changes of glassy carbon electrodes caused by their exposure to OH<sup>•</sup> radicals.” *Electrochem. Commun.* 12 (2010) 1531-1534.

IF: 4.425

My contribution: 15 %. I have prepared the samples for XPS and Ramman analysis. I have also analyzed the results.

- D14. A.M. Nowicka<sup>\*</sup>, E. Zabost, E. Gilant, Z. Stojek; „Influence of percentage of guanine molecules, OH radicals, UV irradiation and temperature on electrooxidation of short synthetic oligonucleotides.” *Phys. Chem. Chem. Phys.* 13 (2011) 7500-7507.

IF: 3.829

My contribution: 40 %. I have planned and overseen the investigations reported in this paper. I have performed the measurements concerning the effects of hydroxyl radicals and UV irradiation on DNA electroactivity. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D15. A.M. Nowicka<sup>\*</sup>, U. Hasse, M. Donten, M. Hermes, Z. Stojek, F. Scholz; „The treatment of Ag, Pd, Au and Pt electrodes with OH<sup>•</sup> radicals reveals information on the nature of the electrocatalytic centers.” *J. Solid State Electrochem.* 15 (2011) 2141-2147.

IF: 2.279

My contribution: 35 %. I have planned and overseen the electrochemical investigations reported in this paper. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D16. E. Zabost, A.M. Nowicka, Z. Mazerska, Z. Stojek; „Influence of temperature on dissociation of ligand-DNA complexes of various type of binding. Electrochemical, UV-Vis- and CD spectroscopic examinations.” *Phys. Chem. Chem. Phys.* 14 (2012) 3408-3413.

IF: 3.829

My contribution: 5 %. I have analysed the results.

- D17. T. Rapecki, M. Donten, A.M. Nowicka, Z. Stojek; „Influence of etching of polycrystalline Au-, Pt- and glassy carbon surfaces with OH radicals on electrodeposition of metals.” *J. Electroanal. Chem.* 677-680 (2012) 83-89.

IF: 2.672

My contribution: 5 %. I have discussed the results.

- D18. A.M. Nowicka, A. Kowalczyk, M. Bystrzejewski, M. Donten, Z. Stojek; „Carbon-encapsulated iron nanoparticles used to generate magnetic field and to enhance substrate transport at electrode surface.” *Electrochem. Commun.* 20 (2012) 4-6.

IF: 4.425

My contribution: 15 %. I have performed a part of electrochemical experiments and analysed them. I have also written the draft of ms..

- D19. D. Nieciecka, K. Nawara, K. Kijewska, A.M. Nowicka, M. Mazur, P. Krysinski; „Solid-core and hollow magnetic nanostructures: Synthesis, surface modifications and biological applications.” *Bioelectrochem.* (2012)  
doi: 10.1016/j.bioelechem.2012.06.001

IF: 3.659

My contribution: 5 %. I have performed the gravimetric experiments.

- D20. P. Olejnik, B. Palys, A. Kowalczyk, A.M. Nowicka; „Orientation of laccase on charged surfaces. Mediatorless oxygen reduction on amino- and carboxyl- ended ethylphenyl groups.” *J. Phys. Chem. C* 116 (2012) 25911–25918.

IF: 4.814

My contribution: 30 %. I have planned and overseen the electrochemical and gravimetric investigations reported in this paper. I have also analysed the results, written the draft of ms..

- D21. A.M. Nowicka<sup>\*</sup>, A. Kowalczyk, A. Jarzebinska, M. Donten, P. Krysinski, Z. Stojek, E. Augustin, Z. Mazerska; „Progress in targeting tumor cell by using drug-magnetic nanoparticles conjugate.” *Biomacromolecules* 14 (2013) 828-833.

IF: 5.371

My contribution: 35 %. I have planned and overseen the electrochemical and gravimetric investigations reported in this paper. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D22. A. Kowalczyk, M. Fau, M. Karbarz, M. Donten, Z. Stojek, A.M. Nowicka<sup>\*</sup>; „Hydrogel with chains functionalized with carboxyl groups as universal 3D platform in DNA biosensors.” *Biosens. Bioelectron.* (2013), <http://dx.doi.org/10.1016/j.bios.2013.11.017>.

IF: 5.437

My contribution: 25 %. I have planned and overseen the electrochemical and gravimetric investigations reported in this paper. I have also analysed the results, written the ms., corresponded with the editor and edited the replies to reviewers' comments.

- D23. A.M. Nowicka, A. Kowalczyk, M. Bystrzejewski, M. Donten, M.L. Donten, Z. Stojek; „Carbon-encapsulated iron nanoparticles as ferromagnetic matrix for oxygen reduction in absence and presence of immobilized laccase.” *Electrochim. Acta*, <http://dx.doi.org/10.1016/j.electacta.2013.08.027>.

IF: 3.777

My contribution: 20 %. I have performed the electrochemical investigations in the absence and presence of magnetic field. I have also analysed the results, written the draft of ms..

- D24. A.M. Nowicka<sup>\*</sup>, B. Krasnodebska-Ostrega, B. Wrzosek, M. Jastrzebska, M. Sadowska, M. Mackiewicz, Z. Stojek; „Detection of oxidative damage of synthetic oligonucleotides caused by thallium(III) complexes.” *Electroanalysis*, accepted for publication.

IF: 2.721

My contribution: 35 %. I have planned and overseen the investigations reported in this paper. I have done all gravimetric and voltammetric measurements and



analysed these results. I have written the ms., corresponded with the editor and edited the replies to reviewers' comments.

### **Chapter in book**

M. Hepel, M. Stobiecka, and A. M. Nowicka, Nanogravimetric and voltammetric DNA-biosensors for screening of herbicides and pesticides, in: Biosensors and Environmental Health, V.R. Preedy, V. Patel (Eds.), CRC Press, Boca Raton, FL, 2012, pp. 230-255; ISBN: 978-1-57808-735-8.

*Anna M. Nowicka*

### **5.4. Summary of scientific activity related to papers listed in section 5.3.**

During my PhD studies my research interests were focused on the migrational and convectional transport of analytes in solutions. Both theoretical and experimental complex approaches were undertaken to solve the selected problems. Finally, I got a good lesson of organic synthesis, spectroscopy, electrochemistry, modeling of compounds and computer calculations [M1-M6].

After PhD thesis defense I decided to concentrate on biochemical issues. I was particularly interested in such processes as denaturation and hybridization of DNA and in the effects of interactions between DNA and drugs. Electrochemistry gives a chance of deeper insight into these processes, since it allows monitoring chemical changes in particular molecules built into DNA strands. The first aim in my research was to perfect the spectroelectrochemical and electrochemical procedures to be able to characterize quantitatively the interactions between DNA and potential anticancer drugs [D2,D3,D5,D7,D10,D16].

The new possibilities of electrochemical examination of DNA were related to the electrochemical anodic activity of guanine and adenine. The previous lack of such data for DNA strands dissolved in a solution was caused by relatively fast decay of the electrooxidation signals and the corresponding poor reproducibility of the measurements. These obstacles were a consequence of contamination of DNA samples with proteins and inappropriate measurement methodology. I have found the conditions for good reproducibility of the electrooxidation of guanine and adenine: the solution and the electrochemical cell should be biologically and chemically pure [D1]. A possibility of independent analysis of electrochemical signals of DNA and a selected drug made possible the determination of the equilibrium constant of the drug-DNA interactions and the number of coordination sites needed to bind one drug molecule. Having this possibility I could examine how the binding capability of the drug changes when

a magnetic nanoparticle carrier is attached to the drug [D9,D19]. Cytotoxicity of anticancer drugs in healthy cells is very undesirable. It can be substantially limited by e.g. directing the drugs selectively to the cancer cells. One of good ideas is the attachment of a magnetic nanoparticle to the drug molecule. By applying the magnetic field it is possible to direct such a conjugate selectively to the ill cells. Some questions arise here: will the drug modified with a nanoparticle maintain its cytotoxicity? Will the interaction with DNA preserve its original character and strength? Will the nanoparticle be released in the cancer cell? I have tried to find answers to these questions. The corresponding work has been described in publication [D21]. The measurements of cytotoxicity of DOX-Fe<sub>3</sub>O<sub>4</sub> Np. conjugate were done by dr. Ewa Augustin and dr. hab. Zofia Mazerska from Department of Pharmaceutical Technology and Biochemistry, Gdansk University of Technology

The results of investigation of the strength of the dsDNA – potential-drug interactions may be helpful in planning chemical modifications of the anticancer drugs. I want to stress here that the work in the anodic range gave not only a possibility of successful electrochemical and spectroelectrochemical investigation of interactions between dsDNA and chemical compounds but also enabled fuller analysis of the denaturation process and the influence of the potential drugs on that process. So far the electrochemical investigation of the DNA denaturation process was carried out with DNA accumulated on the electrode surface. For the accumulated DNA the changes in the voltammetric signal caused by the denaturation process appeared exactly at the same temperature range as they did in the spectrograms. The formation of the DNA solid state apparently hides some properties of individual strands. It became clear after voltammetric examination of dissolved DNA. Additional effects appeared in the voltammograms and that allowed drawing more significant conclusions. The differences appeared in a temperature range preceding the denaturation process [D8,D14]. They prompted me to do an examination with circular dichroism spectroscopy. Significant changes in the ellipticity of the dsDNA molecules were seen in the temperature range where new voltammetric effects appeared. The observed changes could be related to a conformation transformation of the helical dsDNA structure and, in consequence, to better exposition of guanine and adenine for the electrooxidation. I expected that in the presence of compounds that can interact with dsDNA, both: electrochemical and spectroscopic signals should change. My expectations were fulfilled.

A subject parallel to the above problems is using the DNA biosensors as multitask tools for analytical and physicochemical purposes [H1-H12]. The quality

of the sensing layer becomes the major issue here. It is strongly related to the way the biomolecules are immobilized on the substrate surface [D6,D20,D22].

I did not limit myself to the research with biomolecules. During my stay in Greifswald, Germany I spent some time investigating the action of hydroxyl radicals against the gold electrode surface. Classical Fenton solution was used as a source of the radicals. The results were astonishing [D11,D12]. They changed our view on the problem of the electrochemical activation and polishing of gold. These investigations were continued with other electrode materials [D13,D15,D17].

Recently, I have started the research on the influence of outer magnetic field on the intensity of voltammetric signals of paramagnetic substrates. [D18,D21,D23].

*Anna M. Nawicka*

## 6. INFORMATION ON OTHER ACTIVITIES

### 6.1. Teaching activities

I took the following classes:

Faculty of Chemistry, integrated 5-year studies, undergraduate studies and graduate studies:

- repetitions and General Chemistry laboratory
- Analytical Chemistry laboratory
- Inorganic Chemistry I laboratory
- Inorganic Chemistry II laboratory

Faculty of Biology, integrated 5-year studies and undergraduate studies:

- repetitions and General and Analytical Chemistry laboratory

Interfaculty program, Engineering of Nanostructures, undergraduate studies:

- Analytical Chemistry laboratory

Interfaculty program, Environment Management, graduate studies:

- Environment Analytics laboratory, one exercise in Polish and English

Other forms of didactic activity:

- work for The National Fund for Children

Activity in the events aimed at popularization of science:

- participation in Science Festival in Warsaw, from 2005.

*Anna M. Nawicka*

## 6.2. Scientific care over students

I have been scientific adviser for the following students:

### Bachelor thesis:

- Edyta Matysiak (2010) – „Influence of length of oligonucleotide chain on electrooxidation of guanine”
- Marta Kaczyńska (2011) – „Ways of investigations of drug-DNA interactions”
- Magdalena Jastrzębska (2011) – „Influence of reactive oxygen species on physicochemical properties of oxygen”

### MSc thesis:

- Agnieszka Laba (2005) – „Voltammetric investigation of interactions between DNA and anticancer drug C-1311”;
- Agata Kowalczyk (2007) – „Interactions of dsDNA and drugs in polymeric matrix”;
- Barbara Klim (2008) – „Investigation of interactions between dsDNA and C-1305 at various pH”;
- Michał Fau (2010) – „Application of 4-aminoethylbenzenediazonium tetrafluoroborate for construction of DNA hybridization biosensor with electrochemical impedance detection”;
- Stefania Iwanowska (2010) - „Electrochemical and spectroscopic investigation of AG99p – a *cis*-Pt derivative”;
- Edyta Domel (2010) – „Influence of number of guanine molecules in strand on denaturation of dsDNA. Electrochemical and spectroscopic investigations”;
- Aleksandra Sikora (2010) – „Electrochemical and spectroscopic characterization of dsDNA interactions with free and modified with a magnetic nanoparticle doxorubicin”;
- Marcin Maćkiewicz (2011) – „Influence of way of binding of oligonucleotide molecular probe to substrate on DNA biosensor work”;
- Edyta Matysiak (2012) – „Influence of UV irradiation and Tl(I) ions on physicochemical properties of physiologically important DNA sequences”;
- Magdalena Jastrzębska (2013) – „Influence of Tl(III) complexes on physicochemical properties of physiologically important DNA sequences”;
- Anita Jarzębińska (2013) – „Biological activity of doxorubicin-magnetic nanoparticle conjugate against cancer cells”;
- Marta Kaczyńska (2013) – „Modification of gold substrate with phenyl groups of diazonium salt formed *in situ*”.

### PhD thesis:

- mgr Ewelina Zabost (2010) – „Changes in properties of double stranded DNA caused by chemical interactions and external physicochemical parameters”; auxiliary advisor
- mgr Agata Kowalczyk (2012) – „Improvements of layer modifying electrode and detection of hybridization process in DNA biosensors”; auxiliary advisor
- mgr Michał Fau (graduate student) – Mono- and policomponent layers for control of adsorption of biomolecules on different materials; auxiliary advisor

*Anna M. Nawicka*

### **6.3. Engagement in scientific projects**

- Grant KBN for graduate students 4 T09A 052 24 (2004/05): „Metalocene derivatives as model compounds for investigation of diffusional and migrational transport”; main investigator (project completed)
- Grant KBN 3 T09A 087 27 (2004/07): „Physicochemical investigation of gel- and ionic liquid media and investigation of transport of ions and molecules in those media”; investigator (project completed)
- Grant KBN N-N204 244534 (2008/11): „Chemical reactions associated with electron and ion transfer at boundary of three phases and their application for synthesis of new materials”; investigator (project completed)
- BW-175609 (2007): „Sensors based on enzymatic reaction and red-ox polymers – mediators for amperometric detection of DNA hybridization”; coordinator (project completed)
- BW-179213 (2008): „Application of intercalators as factors that modify dsDNA structure and their use in biosensors based on hybridization process of DNA”; coordinator (project completed)
- BW-175609 (2009): „Change in DNA structure caused by attack of toxicants, free radicals and ionizing irradiation. Influence of base sequence in strands”; coordinator (project completed)
- Grant Iuventus Plus IP2010 028570 (2011): „Mono-component and complex nanostructural materials of desired properties”; coordinator (project completed)
- 501/86-DSM-120400 (2012): „Magnetic nanoparticles as carriers for anticancer drugs. Synthesis, cytotoxic investigation and interactions with DNA”; coordinator (project completed)

- Grant Iuventus Plus IP2011 025971 (2012/13): „New compounds for immobilization of biomolecules on surfaces of various materials”; investigator (project completed)
- Grant Iuventus Plus IP2011 038871 (2012/14): „Influence of sequence of nitrogen bases in DNA strand on its conformation, activity against drugs and its resistance to toxicants”; coordinator (project in progress)

*Anna M. Nowicka*

#### **6.4. Scientific visits in other scientific and academic centers**

- 2003 – USA, City University of NY, New York, 3 months;
- 2006 – Ireland, National University of Ireland, Galway, 1 month;
- 2009 – USA, City University of NY, Potsdam, 3 months;
- 2009 – Germany, Institut für Biochemie, Universität Greifswald, 2 months.

*Anna M. Nowicka*

#### **6.5. Scientific awards/prizes**

- 2005 r. – W. Kołos prize for PhD thesis
- 2008 r.– Scientific stipend from UW Rector
- 2010 –W. Kemula prize for works on preparation of gold and graphite surfaces for molecular sensor layers
- 2010/11 – Scientific stipend for best PhD students and young doctors
- 2011/14 –Stipend of Minister of Science and Higher Education for outstanding young scientist
- 2013 r.- Scientific prize, Faculty of Chemistry UW

*Anna M. Nowicka*

#### **6.6. Participation in local and international scientific conferences**

##### Participation in scientific conferences during PhD studies:

##### *A: Local meetings*

1. A.M. Nowicka, Z. Stojek; Olsztyn (2000), Mikrosymposium Sieci Chemii Supramolekularnej, oral presentation: „Application of substituted ferrocene derivatives in the investigation of mixed diffusional and migrational transport.”

2. A.M. Nowicka, Z. Stojek; Mogilany (2001), Elektroanaliza w teorii i praktyce IV, poster presentation: „Chronoamperometria monopodstawionych pochodnych ferrocenowych.”
3. A.M. Nowicka, Z. Stojek; Olsztyn (2001), Mikrosymposium Sieci Chemii Supramolekularnej, oral presentation: „Synthesis and microelectrochemical studies of some bis-ferrocenyl compounds.”
4. W. Hyk, A.M. Nowicka, Z. Stojek; Mogilany (2003), Elektroanaliza w teorii i praktyce V, oral presentation: „Procesy elektrodowe typu charge reversal w roztworach o niskiej mocy jonowej.”

*B: International meetings*

1. A.M. Nowicka, W. Hyk, Z. Stojek; San Francisco (2001), 52<sup>nd</sup> ISE Meeting, poster presentation: „Extension of classical relations used in electroanalysis to conditions of mixed diffusion – migration transport.”
2. W. Hyk, A.M. Nowicka, Z. Stojek; Kraków (2002), ESAC Meeting, poster presentation: „Low – support chronoamperometry at microelectrodes as a promising tool for the determination of diffusion coefficients of substrate and product.”
3. W. Hyk, A.M. Nowicka, Z. Stojek; Duesseldorf (2002), 53<sup>rd</sup> ISE Meeting, oral presentation: „Parallel electrode processes at microelectrodes under diffusion-migration conditions.”
4. W. Hyk, A.M. Nowicka, Z. Stojek; Gdańsk (2003), 3<sup>rd</sup> Baltic Conference on Electrochemistry, poster presentation: „Voltammetric studies of the electrostatic interactions in the two – component systems. Parallel electrode reactions.”
5. A.M. Nowicka, W. Hyk, Z. Stojek; Galway (2004), ESAC Meeting, poster presentation: „Influence of convective transport on electrochemical responses in low ionic strength systems”
6. A.M. Nowicka, M. Pałys, M. Donten, Z. Stojek; Szczyrk (2004), International Conference on Electrode Processes, oral presentation: „Influence of convection and position of electrode vs. flow direction on electrochemical responses in low ionic strength systems.”
7. A.M. Nowicka, W. Hyk, Z. Stojek; Thessaloniki (2004), 55<sup>rd</sup> ISE Meeting, oral presentation: „The extreme migrational enhancement of faradaic current at microelectrodes. Experimental and theoretical studies.”

8. A.M. Nowicka, M. Pałys, M. Donten, Z. Stojek; Greifswald (2005), 4<sup>th</sup> Baltic Conference on Electrochemistry, poster presentation: „Competition of migration and convection in microtube/microelectrode flow system.”

#### Participation in scientific conferences after PhD studies:

##### *A: Local meetings*

1. A.M. Nowicka, E. Zabost, Z. Mazerska, Z. Stojek; Przegorzały (2006), Elektroanaliza w teorii i praktyce VI, poster presentation: „Anodic characteristic dissolved dsDNA with *on line* UV-Vis spectroscopy.”
2. A.M. Nowicka, E. Zabost, Z. Mazerska, Z. Stojek; Gdańsk (2006), PTChem, oral presentation: „Elektrochemiczne i spektroelektrochemiczne kryteria detekcji oddziaływań podwójnej nici DNA z lekami.”
3. A.M. Nowicka, Z. Stojek, D. Leech; Kraków (2007), Elektroanaliza w teorii i praktyce VII, oral presentation: „Woltamperometryczna i amperometryczna detekcja hybrydyzacji DNA z użyciem mikroelektrod.”
4. A.M. Nowicka, A. Kowalczyk, Z. Stojek, D. Leech; Kraków (2008), Elektroliza w teorii i praktyce VII, oral presentation: „Sensory oparte na reakcji enzymatycznej i mediatorach redoks do amperometrycznej detekcji hybrydyzacji DNA.”
5. A.M. Nowicka, A. Kowalczyk, M. Donten, Z. Stojek; Kraków(2010), VIII Polska Konferencja Chemii Analitycznej, oral presentation: „Doskonalenie warstwy receptorowej i metody detekcji w bioczuJNIKACH hybrydyzacji DNA”
6. A.M. Nowicka, A. Kowalczyk, P. Krysiński, Z. Mazerska, E. Augustin, M. Donten, Z. Stojek; Kraków (2011), Elektroanaliza w teorii i praktyce, oral presentation: „Modyfikacja doksorubicyny nanocząstkami magnetycznymi jako sposób zwiększenia jej bioaktywności w stosunku do komórek nowotworowych.”
7. A. Kowalczyk, A.M. Nowicka, M. Fau, Z. Stojek; Kraków (2011), Elektroanaliza w teorii i praktyce, oral presentation: „Zastosowanie 4-aminoetylo-benzenodiazoniowej soli tetrafluoroboranu do konstrukcji biosensora DNA z elektrochemiczną detekcją impedancyjną.”



*B: International meetings*

1. A.M. Nowicka, E. Zabost, M. Donten, Z. Mazerska, Z. Stojek; Bordeaux (2006), ESEAC Meeting, oral presentation: „Electrochemical and spectroelectrochemical procedures for detection of interactions of double stranded DNA with drugs.”
2. A.M. Nowicka, J. Hajdukiewicz, Z. Stojek, D. Leech; Dublin (2007), 5<sup>th</sup> ISE Spring Meeting, poster presentation: „Redox polymer mediation of enzymes for amplified amperometric detection of DNA hybridization.”
3. A.M. Nowicka, A. Kowalczyk, Z. Stojek, D. Leech; Włodowice (2007), SMCBS'2007, oral presentation: „Modification of gold microelectrodes for detection of DNA hybridization.”
4. A.M. Nowicka, E. Zabost, A. Kowalczyk, M. Donten, Z. Mazerska, Z. Stojek; New Orleans (2008), Pittcon, oral presentation: „Anodic voltammetry and spectroelectrochemistry of dsDNA as a way to examination of DNA interactions with drugs and conformation change.”
5. A. Kowalczyk, A.M. Nowicka, E. Zabost, M. Donten, Z. Mazerska, Z. Stojek Gdańsk (2008), PBA, poster presentation: „Anodic voltammetry and spectroelectrochemistry of dsDNA as a way to examination of DNA interactions with drugs in solution and in volume-phase-transition polymeric medium.”
6. A. Kowalczyk, E. Zabost, M. Donten, Z. Mazerska, Z. Stojek; Prague (2008), ESEAC Meeting, oral presentation: „Electroanalytical aspects of interactions of dsDNA with anticancer intercalating drugs.”
7. A.M. Nowicka, A. Kowalczyk, M. Donten, Z. Stojek, D. Leech; Seville (2008), 59<sup>th</sup> ISE Meeting, poster presentation: „Application of colloidal gold in detection of DNA hybridization at gold microelectrodes.”
8. A.M. Nowicka, A. Kowalczyk, M. Donten, P. Krysiński, Z. Stojek; Milan (2009), RDPA, poster presentation: „Examination of interactions between doxorubicin bound to magnetic nanoparticles and dsDNA.”
9. P. Krysiński, A.M. Nowicka, A. Kowalczyk, M. Donten, Z. Stojek; Vienna (2009), The Electrochemical Society Meeting, oral presentation: „Synthesis and surface modifications with doxorubicin of mixed ferrite colloidal magnetic nanoparticles.”
10. A.M. Nowicka, A. Kowalczyk, E. Zabost, M. Donten, Z. Stojek; Łańsk, (2009), Summer School – „Bioelectrochemistry and its applications for the study of the interactions between biomolecules”; oral presentation: „Natural polymer

deoxyribonucleic acid (DNA) – hybridization, denaturation and its interactions with drugs.”

11. A.M. Nowicka, A. Kowalczyk, M. Donten, P. Kryszynski, Z. Mazerska, Z. Stojek; Gijon (2010), ESEAC Meeting, oral presentation: „Interactions with dsDNA and cytotoxic activity towards cancer cells of doxorubicin covalently bound with magnetic nanoparticles.”
12. A.M. Nowicka, A. Kowalczyk, M. Donten, D. Leech, M. Hepel, Z. Stojek; Gijon (2010), ESEAC Meeting, poster presentation: „Influence of anchoring of Au–nanoparticle monolayer to solid gold surface on performance of DNA biosensors.”
13. A. Kowalczyk, A.M. Nowicka, Z. Stojek; Nice (2010), 61<sup>st</sup> ISE Meeting, poster presentation: „Application of 4-aminoethylbenzenediazonium salt to construction of DNA biosensor at glassy carbon electrode.”
14. A.M. Nowicka, M. Hepel, Z. Stojek; Nice (2010), 61<sup>st</sup> ISE Meeting, poster presentation: „Influence of the Cr species on interaction of anticancer drug mitoxantrone with DNA.”
15. E. Zabost, A.M. Nowicka, Z. Mazerska, Z. Stojek; Nice (2010), 61<sup>st</sup> ISE Meeting, poster presentation: „Thermal stability of ligand-DNA complexes formed by different types of interactions. Comparison of results obtained by spectroscopic and electrochemical techniques.”
16. M. Fau, A. Kowalczyk, A.M. Nowicka, Z. Stojek; Kraków (2011), XXI BES, poster presentation: „Influence of design of sensing layer on DNA-biosensor performance.”
17. A.M. Nowicka, A. Kowalczyk, Z. Stojek; Kraków (2011), XXI BES, oral presentation: „Drug – DNA interactions. Different way of examination.”
18. A.M. Nowicka, A. Kowalczyk, F. Scholz, Z. Stojek; Turku (2011), ISE Spring Meeting, oral presentation: „Changes in performance of DNA biosensor caused by hydroxyl radicals”
19. A. Kowalczyk, A.M. Nowicka, F. Scholz, Z. Stojek; João Pessoa (2011), 23<sup>rd</sup> PBA, poster presentation: „Changes in DNA structure and properties as a measure of DNA damage caused by hydroxyl radicals.”
20. A.M. Nowicka, A. Kowalczyk, P. Kryszynski, Z. Mazerska, Z. Stojek; João Pessoa (2011), 23<sup>rd</sup> PBA, poster presentation: „Conjugation of doxorubicin with magnetic nanoparticles as a way for enhancement of bioavailability of the drug in tumor cells.”

21. A.M. Nowicka, M. Fau, A. Kowalczyk, P. Olejnik; Portoroz (2012), ESEAC Meeting, oral presentation: „Phenyl groups perpendicular to gold surface as a way for successful attachment of DNA.”
22. A. M. Nowicka, A. Kowalczyk, P. Krysinski, Z. Mazerska, Z. Stojek; Portoroz (2012), ESEAC Meeting, poster presentation: „Magnetic nanoparticles – promising drug Carrier.”
23. A.M. Nowicka, A. Kowalczyk, S. Sek, Z. Stojek; Portoroz (2012), ESEAC Meeting, oral presentation: „Monitoring of conformation change and damage of double stranded DNA triggered by action of OH<sup>•</sup> radicals.”
24. A.M. Nowicka, A. Kowalczyk, M. Bystrzejewski, M. Donten, Z. Stojek; Prague (2012), 63<sup>rd</sup> ISE Meeting, oral presentation: „Carbon-encapsulated iron nanoparticles used to generate magnetic field and to enhance substrate transport at electrode surface.”
25. Z. Stojek, A.M. Nowicka, A. Kowalczyk, M. Mackiewicz, S. Sek; Prague (2012), 63<sup>rd</sup> ISE Meeting, oral presentation: „Monitoring of conformation change and damage of double stranded DNA triggered by action of OH<sup>•</sup> radicals and UV irradiation.”
26. M. Fau, A. Kowalczyk, P. Olejnik, A.M. Nowicka; Prague (2012), 63<sup>rd</sup> ISE Meeting, poster presentation: „Ways of deposition of phenyl layer on gold surface in successful attachment of DNA.”
27. M. Mackiewicz, B. Krasnodebska-Ostrega, A.M. Nowicka; Prague (2012), 63<sup>rd</sup> ISE Meeting, poster presentation: „Monitoring of interactions between thallium(I) ions and physiologically important DNA sequences by electrochemical, spectroscopic and gravimetric techniques.”
28. A.M. Nowicka, A. Kowalczyk, Z. Stojek; Brno (2012), 45<sup>th</sup> Heyrovsky Discussion: Electrochemistry of Biopolymers and Bioactive Compounds, oral presentation: „Progress in engineering of sensing layer and detection of hybridization in DNA biosensors.”
29. A.M. Nowicka, A. Kowalczyk, M. Fau, Z. Stojek; Hawaii (2012), Pacific Rim Meeting on Electrochemical and Solid - State Science, Honolulu, oral presentation: „Intermediate layers for immobilization of biomacromolecules on various substrates.”
30. A.M. Nowicka, A. Kowalczyk, A. Jarzebinska, M. Donten, P. Krysinski, Z. Stojek, E. Augustin, Z. Mazerska; Bochum (2013), 12<sup>th</sup> BES, oral

presentation: „Targeting tumor cells by using drug-magnetic nanoparticle conjugate.”

31. A. Kowalczyk, M. Fau, A.M. Nowicka, M. Strawski, Z. Stojek; Bochum (2013), 12<sup>th</sup> Topical ISE Meeting, poster presentation: „Phenyl layers – matrix for specific immobilization of biologically important compounds.”
32. A.M. Nowicka, A. Kowalczyk, M. Bystrzejewski, M. Donten, M. Donten, Z. Stojek; Bochum (2013), 12<sup>th</sup> Topical ISE Meeting, oral presentation: „Carbon-encapsulated iron nanoparticles as new ferromagnetic matrix for oxygen reduction in the presence of immobilized laccase.”
33. A.M. Nowicka, A. Kowalczyk, M. Fau, M. Karbarz, M. Donten, Z. Stojek; Santiago de Queretaro (2013), 64<sup>th</sup> ISE Meeting, oral presentation: „Hydrogel with polymer chains grafted and functionalized with carboxyl groups as universal 3D platform for specific immobilization of DNA strands.”

*Anna M. Nowicka*

## **6.7. Reviewer for scientific agencies and scientific journals**

### Reviewer for scientific journals :

- Analytical and Bioanalytical Chemistry: 1
- Chemia Analityczna: 2
- Electroanalysis: 5
- Electrochimica Acta: 3
- Langmuir: 2
- Journal of Physical Chemistry: 2
- Journal of Solid State Electrochemistry: 2
- Talanta: 2

### Reviewer for scientific agencies:

- Polish Scientific Agency NCN discipline ST4

*Anna M. Nowicka*

**Certified translation:**

-/-

[Rectangular stamp: Certified to be a true  
the original

Date                      Signature]  
12.03.2008              [illegible signature]

[Rectangular stamp: Director of the Dean's Office  
Faculty of Chemistry of the University of Warsaw]

Gabriela Lapeczyńska -/-

University of Warsaw  
Faculty of Chemistry  
1 Pasteura Street  
02-093 Warszawa

*Polish national emblem*  
THE REPUBLIC OF POLAND  
UNIVERSITY OF WARSAW -/-  
Faculty of Chemistry -/-

(name of the organizational unit of university or other research organization)

**DIPLOMA**

-/-

**ANNA MARIA NOWICKA -/-**

(full name)

born on                      8<sup>th</sup> December 1976                      in                      Maków Mazowiecki -/-

on the basis of the presented PhD thesis with the title -/-

**"The metallocene derivatives as the model compounds to the study the  
migrational, diffusional and convectational transport"**

and after passing required examinations received a university -/-

**DOCTOR'S DEGREE**

-/-

OF CHEMICAL SCIENCES -/-  
in the scope of CHEMISTRY -/-  
(details of the degree)

granted by the resolution of the Council -/-

of the Faculty of Chemistry of the University of Warsaw -/-

(name of the council and name of the university or other research organization)

of 8<sup>th</sup> of June 2005 -/-

Thesis supervisor in the registration and conferment procedure of a doctoral degree:

*Prof. Zbigniew Stojek, PhD, -/-*

Reviewers in the registration and conferment procedure of a doctoral degree:

*Prof. Zbigniew Galus, PhD, -/-*

*Prof. Władysław Kubiak, PhD, -/-*

Warsaw, 28<sup>th</sup> December 2005 -/-  
(location, date)

-/-



Dean

/illegible signature/

Prof. Grzegorz Chalasiński, PhD/-

./.

seal

Vice-Chancellor

/illegible signature/

Prof. Katarzyna Chalasińska-Macukow, PhD/-

/Round seal/Polish national emblem in the middle/ University of Warsaw\*2\*/

---

I the undersigned Maria – Magdalena Charyło – Samul – a sworn English translator entered into the list of sworn translators under the number of TP/1180/05 by the Minister of Justice, the Republic of Poland, do hereby certify that the above translation is consistent with the original of the document prepared in Polish language.

Warsaw 21<sup>st</sup> November 2008

Rep. number 3471/2008

