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*Welcome to the Faculty of Chemistry
at Maria Curie-Skłodowska University*

The Maria Curie-Skłodowska University was founded on 23rd October, 1944. At the same time the chemistry section being a part of the Faculty of Natural Science also started its activity. The section of chemistry included the Chair of Inorganic Chemistry, the Chair of Physical Chemistry and the Chair of Organic Chemistry founded in 1944-1945. When the Faculty of Mathematics, Physics and Chemistry was established in the academic year 1951-1952, the section of chemistry included four chairs.



The Deans of the Faculty of Chemistry during the period October 1996-1999. From the left: Prof. J. Rayss (V-ce Dean from February 1997), Prof. T. Borowiecki (Dean of the Faculty), Prof. S. Chibowski (V-ce Dean), and Prof. J. Goworek (V-ce Dean).
Photo: W. Rudziński.

The Institute of Chemistry belonging to the Faculty of Mathematics, Physics, and Chemistry was transformed into the Faculty of Chemistry in 1989. At present it includes 15 departments and 4 laboratories. In the Faculty of Chemistry about 290 workers are employed, among them there are 155 university teachers, this number includes 46 professors and assistant professors.

During the academic year 1998-1999 there were 1051 students in the Faculty, who were offered 6 different educational programs.

The Faculty of Chemistry is the largest centre for the studies of interface chemistry and physics in Poland. The scientific activities of many departments concern various interface phenomena oriented investigations. Therefore our Faculty opened the post-graduate studies whose subject is interface chemistry and physics. During the last academic year there were 25 postgraduate students there. Our Faculty also offers a possibility of other postgraduate studies preparing prospective teachers of chemistry. In 1998-1999 there were 52 students. The most talented students are offered a special individual program of studies, aimed at preparing them for a future scientific career. Such a possibility is usually offered to the second-year students.

Below the traditional research areas of the 15 departments and of the 4 laboratories are presented.

1. The Department of Interfacial Phenomena

- Surface and interface tension of liquids and solutions, surface free energy of solids and solid / liquid interfacial free energy, theoretical and experimental development of the methods.
- Properties of solid / liquid and liquid / liquid dispersed systems. Investigation of physical and chemical parameters affecting properties of these systems.
- Theoretical aspects of wettability, adsorption, adhesion and electrochemical phenomena occurring at the interfaces.

2. The Department of Adsorption and Planar Chromatography

- Planar chromatography.
- Optimization of separation in TLC.
- Electrochromatography.
- Investigation of hydrophobicity of various compounds by liquid chromatography.
- Adsorption from gas liquid phase on solids.
- Synthesis of silicalites with ordered porous structure.
- Theoretical and experimental studies of adsorption on energetically heterogeneous solid surfaces.
- Porosity of solids studied by thermal desorption of liquids.

- Modification of silica gels and activated carbons.

3. The Department of Physicochemistry of Solids

- Application of thermal analysis to study: adsorbed liquid films, liquid / solid interactions, heterogeneity of solid surfaces.
- Investigations on the adsorption properties and the porosity of natural and thermally treated dolomite samples.
- The synthesis of magnesium compounds from natural dolomite.
- The preparation of unmodified and chemically modified new adsorbents for gas, planar, and HPLC chromatography.
- Optimization of chromatographic systems: gas / solid and liquid mixtures / solid surface.
- The investigation of adsorption processes in gas / solid and liquid mixtures / solid surfaces systems.

4. The Department of Radiochemistry and Colloid Chemistry

- Studies of the electrical double layer formed at the metal oxide / electrolyte solution interface.
- Adsorption of ions at the solid/electrolyte interfaces.
- Conformation of adsorbed macromolecules at the solid / aqueous solution interface.
- Flocculation.
- Flotation of coal or nonferrous metal ores.
- Processes of some vitamins oxidation in microemulsion systems.
- Radioisotopic pollution of environment.
- Determination of plutonium and americum content in soils.
- Methods of preparation of well defined dispersions of metal oxides.
- Surface properties of organic dispersions in aqueous solutions.

5. The Department of Chemical Technology

- Investigation of heterogeneous catalysts:
 - Catalyst preparation methods, particularly oriented toward preparing a catalyst with a high dispersion of an active phase.
 - Processes of active catalysts formation as a result of their precursors changes.
 - Physico-chemical and kinetic tests of the studied catalysts.
- Changes in catalyst properties due to their deactivation (coking, poisoning, sintering).
- Determination of the adsorption energy function distribution based on TPD measurements – co-operation with the Department of Theoretical Chemistry.

- Applications of the catalysts for the following reactions: steam reforming of hydrocarbons, water gas shift reaction, partial oxidation of methane, hydrogenation of carbon oxides, oxidative coupling of methane, oxidation of hydrocarbons and/or carbon monoxide, gasification of carbonaceous materials, hydrogenolysis of hydrocarbons.
- Cooperation of industry and municipal authorities on the natural environment:
 - Decreasing of harmful pollutants (SO_2 , NO_x , CO) emission from power industry to atmosphere – co-operation with the Laboratory of Environmental Chemistry.
 - Investigations of furnace residues of power industry.
 - Structure modification of porous materials (carbons, oxides) for their future applications in adsorption and catalysis – co-operation with the Department of Chemical Physics and Physicochemical Separation Methods .
 - Waste management – analysis of municipal and industrial waste dumps operation (co-operation with the Lublin Urban Enterprise of water supply and sewage systems).
 - Investigations of energetic utilisation processes of plastic wastes.

6. The Department of Chemical Physics and Physicochemical Separation Methods

- Chromatography and related methods:
 - Synthesis of chemically bonded stationary phases and preparation of columns for chromatography and capillary electrochromatography (CEC).
 - Supercritical fluid extraction (SFE) of biologically active compounds from plants.
 - Accelerated solvent extraction (ASE) of complex natural mixtures.
 - Supported liquid membranes (SLM) as a sample preparation method for chromatography (clinical, environmental, and toxicological analysis).
 - Capillary electrophoresis (CE) and capillary electrochromatography (CEC) – fundamental studies and application.
 - Capillary gas chromatography in chiral analysis.
 - Chromatographic and electromigration methods in food analysis.
 - Affinity chromatography as a separation method of biomolecules.
 - Chromatographic analysis of pharmaceutical species.
 - Chromatography as a method of physicochemical investigation.
 - Analysis of volatile organic compounds in the environment with purge and trap and gas chromatography.
 - Analysis of inorganic anions in water with ion chromatography (ICHPLC).
 - Chromatography in physicochemical and analytical application.
- Synthesis and studies of the properties of sorbents for adsorption and chromatography.

- Investigations of porous material structure.
- Studies of adsorption from liquids on solid surfaces.
- Preparation of support materials applied in microbiological and enzymatic processes.
- Preparation and investigations of carbon, carbon-mineral, and mixed oxide adsorbents.
- Investigations of adsorption of organic and inorganic compounds on modified carbon adsorbents.

7. The Department of Theoretical Chemistry

- The Gague Including Atomic Orbitals (GIAO) theory of the nuclear magnetic shielding tensor.
- Parallel computations of the NMR shielding tensor in large molecules.
- Magnetic shielding surface in molecules.
- Efficient methods for electron repulsion integrals and their derivatives.
- Modelling of simple ion adsorption within the electrical double layer formed at the oxide / electrolyte interface.
- Enthalpic effects accompanying simple ion adsorption at the oxide / electrolyte interface.
- Effects of the energetic heterogeneity of the real oxides on the simple ion adsorption at the oxide / electrolyte interface.
- Modelling the adsorption of both ionic and nonionic surfactants from aqueous solutions at the oxide / electrolyte interface.
- Theoretical description of gas adsorption in zeolites.
- Studies of mixed-gas adsorption by solids.
- Theory and practical aspects of gas and liquid adsorption on solid surfaces
- Theory of solid / liquid adsorption chromatography.
- Preparation and investigations of new adsorbents for adsorption chromatography and environmental task – cooperation with the Department of Chemical Physics and Physicochemical Separation Methods.
- Practical aspects of adsorption technology in industry and environmental protection.
- Kinetics of metal ion adsorption from aqueous solutions.

8. The Department of Modelling of Physicochemical Processes

- Theory of non-uniform fluids.
- Adsorption of fluids on various materials, for example: on heterogeneous planar surfaces, on crystals, in pores, in random porous media, on colloidal particles, on soils, etc.
- Phase transitions in surface layers.

- Fluids in contact with semipermeable membranes.
- Theory of chemical equilibrium.

9. The Department of Analytical Chemistry and Instrumental Analysis

- Determination of traces of Cr(VI) in the presence of excess of Cs(III) and humic acids (by catalytic stripping voltammetry).
- Adsorption of organic substances at the mercury electrode and its influence on the electrode processes.
- Construction and examination of new kinds of chemical sensors in the aspect of their practical use as well as of potential creation mechanisms.
- Concentration profiles in solution at electrodes.
- Spectrophotometric investigations of the transport of some bioactive substances through membranes.
- The voltammetric investigations of nucleophilic reactions of o-quinones with ammonia.

10. The Department of Crystallography

- X-ray structure analysis of single crystals:
 - Interactions of glucose-1-phosphate anion with monovalent cations.
 - Stereochemistry of heterocyclic compounds: drug derivatives and potential drugs.
 - Polymorphism of molecular crystals.
 - Crystal chemistry of molecular complexes and inclusion compounds.
- Applied X-ray crystallography: Small angle X-ray scattering investigations of: porous materials; coated siliceous materials; grain extrudates.

11. The Department of General Chemistry

The research in the Department of General Chemistry is mainly oriented toward the coordination chemistry of rare earth and d-electron elements.

The studies are concerned with the preparation of new complexes of rare earth elements and some d-electron elements with organic ligands especially with isomers of amino-, hydroxy-, chloro-, methylo-, methoxy, nitrocarboxylic acids and N-donor ligands in the solid state, and with the determination of their physicochemical properties, the mode of metal-ligand coordination, the structure of the complexes and their thermal stability.

The research is concerned also with the investigations of the influence of metal ions in the lanthanide series on the structure and properties of the complexes with the same ligand and with the influence of the ligand, its structure and position of the substituent in the ring or chain on the properties of the complexes with the corresponding metal ion.

New complexes of rare earth elements and some d-electron elements have often interesting properties, which can find practical application in many branches of techniques and medicine.

12. The Department of Inorganic Chemistry

- Chemistry and technology of rare earth elements.
- High-purity materials.
- Research on foundations of the ion-exchange separation process of d- and f-electron elements.
- Physicochemical foundations of extraction processes.
- Application of ion-exchange and extraction processes in the environmental protection.
- Bioinorganic chemistry – porphyrins complexes with d- and f- electron metals.
- Microprobe measurements by optical, x-ray and electron devices.
- X-ray optics, x-ray capillary waveguides.

13. The Department of Polymers and Technology

- Synthesis of polymeric sorbents for chromatography.
- Relationships between synthesis method and internal structure of polymers.
- Use of polymeric sorbents in the analysis of priority pollutants in air and water.
- Synthesis and modification of unsaturated polyester resins.
- New curing and accelerating agents.
- Thermomechanical properties of the resins.
- Recycling of waste polymers.

14. The Department of Organic Chemistry

- Organic synthesis.
- Stereoselectivity.
- Chirality.
- Asymmetric synthesis.
- Asymmetric catalysis.
- Organophosphorus chemistry.
- Transition metals in synthesis.
- Organometallics.
- Heterocycles.
- Cycloadditions.

15. The Department of Organic Chemistry and Technology

- Polythioesters.
- Polysulfides.
- Aromatic dithiols.
- Polyurethanes.
- Biological activity.
- Bis-chloromethyl hydrocarbons.
- Polymers containing a sulfur atom in the main chain.
- Polyaddition optimal conditions.
- Thermal stability.

16. The Laboratory of Environmental Chemistry

The research of the Laboratory is focused on heterogeneous catalysts used to remove impurities from exhaust gases, preparation of catalysts and their investigations. The investigations include:

- Catalysts for DESONOX processes (for hard coal).
- Catalysts for DESONOX processes (generally for mobile sources).
- New catalysts for isomerization and hydrogenolysis of hydrocarbons.
- Impregnation methods for catalyst preparation aimed at obtaining high metal dispersion (with application of DIM technique).

The Laboratory of Environmental Chemistry also carries out the studies devoted to the atmospheric dust pollution (suspended particulate matter, airborne particles) in some places in Poland.

17. The Laboratory of Optical Fibre Technology

The Laboratory is the only one in Poland dealing with the problems of optical fibres technology. The researches include:

- Studies on the methods of preparation of super pure raw materials for optical fibres technology.
- New optical fibres technologies, including the optical fibres doped with rare earths for optical amplifiers and fibre lasers as well as special fibres for sensors and medicine.
- Application of new UV-cured polymers for optical fibre protective coatings.
- Investigations of adsorption and adhesion phenomena on the polymer protective coating – optical fibre interface.

18. The Laboratory of Chemical Education

- Educational efficiency of a new method for atomic theory teaching.
- Determination of professional profile of chemistry teachers.
- Function of theoretical models in chemistry teaching.

- Contents and structure of modern curricula for chemistry and integrated science subject teaching.

19. The Faculty Analytical Laboratory

The Laboratory is equipped with the following heavy and modern apparatus:

- XRD (X-Ray Diffraction) Spectrometer.
- XRF (X-Ray Fluorescence) Spectrometer.
- FT-NMR (Fourier Transform Nuclear Magnetic Resonance) Spectrometer.
- FT-IR (Fourier Transform Infrared) Spectrometer.
- AA (Atomic Absorption) Spectrometer.
- Surface Area and Porosity Analyser.
- CHN Elemental Analyser.
- Flow Microcalorimeter.
- Electron Microscopes.

During the academic year 1998-1999 members of our faculty published 168 papers in international journals and 61 papers in domestic journals. They have also published 91 articles and 79 short reports in various conference materials. Two books were also published, and two others are in press.

Professors and doctors of our chemistry faculty are active members of many domestic and foreign scientific organizations. Some of them are also members of the editorial boards of some scientific journals:

- Prof. J. Różyło is a member of the editorial board of "*Journal of Planar Chromatography*", "*Acta Chromatographica*" and "*Chemical and Environmental Chemistry*".
- Prof. E. Chibowski is a member of the editorial board of "*Journal of Adhesion Science and Technology*".
- Prof. W. Rudzinski is a member of "*Adsorption – Journal of the International Adsorption Society*", and of "*Adsorption Science & Technology*".
- Prof. Z. Hubicki is a member of the editorial board of the Polish journal "*Wiadomości Chemiczne*" ("*Chemical News*").
- Prof. J. Rayss is a member of the editorial board of "*Elektronika*" ("*Electronics*").
- Dr. J. Ryczkowski is an official correspondent for "*Applied Catalysis A – News Brief*".

Very important for maintaining a high-standard research in our faculty is the cooperation with foreign scientific centers. Joint projects and the following joint publications show cooperation with scientists from more than 40 countries including USA, France, Germany, Canada, Sweden, Spain, Ukraine, Russia,

Italy, Mexico, Hungary, the Czech Republic and UK. Over 40 foreign scientists visited our faculty last year, and 17 scientists from our faculty paid visits to foreign scientific centers. Among them there were 6 long-period visits.

Continually growing participation in domestic and international conferences is an important part of the scientific activities of our faculty. Thus, during the last 1998-1999 academic year 76 faculty members took part in international conferences, and more than one hundred scientists participated in various domestic conferences.

The growing international recognition of our faculty is reflected by the fact of being invited to be members of scientific committees of several international meetings.

At the same time, the scientists of our faculty organize both domestic and international conferences. Some of them have already a well-established international reputation. During the last 1998-1999 academic year the following conferences were organized:

- "IX Polish Chromatographic Seminar – Science & Industry".
- 3rd International Symposium "Effects of Surface Heterogeneity in Adsorption and Catalysis on Solids", organized jointly by Nicolas Copernicus University in Toruń, Maria Curie-Skłodowska University, Queen's University in Canada and Polish Chemical Society.
- III Polish-Ukrainian Symposium: "Theoretical and Experimental Studies of Interfacial Phenomena and Their Technological Applications", organized jointly with the Institute of Colloid Chemistry & Chemistry of Water of the Ukrainian Academy of Sciences.
- VII Polish Conference: "Teachers of Natural Sciences".
- IX Polish Conference "Chemistry" devoted to educational and organizational problems of the chemistry faculties at Polish Universities.
- VII Polish Conference "Environmental Protection" devoted specially to the environmental education of chemistry students.
- "4th Polish – Ukrainian Symposium on Theoretical and Experimental Studies of Interfacial Phenomena and Their Technological Applications", organized jointly with the Ukrainian Academy of Sciences.
- "5th International Seminar on Catalytic DENOX".
- VII Polish Conference "Glass Fibers and Their Applications", organized jointly with the Technical University in Lublin.

The outstanding scientific achievements of many members of our faculty resulted last year in some awards by the Polish Ministry of Education, the President of the Polish Committee for Scientific Research – KBN, and by Rector of Maria Curie-Skłodowska University. The scientific achievements of our Faculty of Chemistry have also been highly evaluated at the ranking of

Polish chemistry faculties, carried out periodically by the Committee for Scientific Research – KBN. Our faculty has been given the A rank in the country.

Although the scientific activities of our community of chemists are well reflected by many papers published in various journals, we feel, that there is a need for having a special publishing forum – the Chemical ANNALES UMCS. Our university journal is not aimed at competing against many existing chemical journals.

The purpose of one-year-issue of ANNALES is to expose current trends in the faculty research, and to provide more information about the whole chemical community. We believe that this information will be warmly received by many scientists abroad, who are interested in a possible scientific cooperation with us. The one-year-issue presents also the results of the already existing cooperation with our Colleagues from foreign scientific centres.

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W. Rudziński

(Prof. dr hab. Władysław Rudziński)



