

**50<sup>th</sup> Jubilee Congress of the Polish Chemical Society  
and Polish Association of Chemical Engineers**

Toruń, Poland, September 9<sup>th</sup> to 12<sup>th</sup>, 2007

Modern chemistry is related to different fields of present life. It would be not reliable and not precise to consider them as classical element of life sciences extracted from whole chemistry. The development of civilization, which people meet with, forced to interdisciplinary approach in the different scientific fields, and in consequence to look wider at the interpretation of phenomena surrounded us and concerned the man.

Such challenge of civilization as well as the scrutiny, in spite not only of the subtle differences on the cellular but also molecular level, theoretical as well as the experimental chemists was established as an aim of 50<sup>th</sup> Jubilee Congress of the Polish Chemical Society and Polish Association of Chemical Engineers and 11<sup>th</sup> International Conference on Chemistry and the Environment of European Association for Chemical and Molecular Sciences, which have been held on September 9–12, 2007 in Toruń, Poland. Members of these two prominent scientific societies have chosen Toruń for the place of their debate as one of the oldest cities in Poland, the city with its rich history and traditions and with strong scientific centre such as the Nicolaus Copernicus University. It is 50<sup>th</sup> time when the Polish chemists met together to present and summarize the most important events which took place in different fields of chemistry in Poland during the recent time.

History of the Polish Chemical Society begins in 1919 and its continuing evolution corresponds very well with motto of the Congress and Conference: *Chemistry, Environment and Human Activity in Civilizing Progress*. The motto explicitly shows the place which present chemistry occupies and points which parts of chemical sciences play in the civilization development. The variety of subjects and questions testify about interaction between different fields, from chemistry, biology, medicine, pharmacy, computer science, engineering to education. These interdisciplinary considerations touched also the sphere of socio-economic and ethical questions.

In these two important meetings we have gathered about 1200 participants from 39 countries of America, Asia, Africa and Europe. There were delivered 270 lectures and about 850 posters were presented. The Opening Ceremony of the Congress was held in the Aula Magna of the Nicolaus Copernicus University on Sunday, September 9<sup>th</sup>. Prof. Dr. Richard Ernst, Nobel Price Laureate, Swiss Federal Institute of Technology, Zurich, presented the Opening Address – *The role of science in the civilization development and progress*. The conference scientific program has concerned: organic, supramolecular, coordination, bioinorganic, polymer, biopolymer, physical,

theoretical, material and nanomaterial chemistry, chemical technology and engineering, chemistry in art and monument conservation, structural chemistry and molecular modeling. Analytical and environmental chemistry section has included bioaccumulation and bioanalysis, chemometry and modeling, food and fodder analysis, green chemistry, monitoring, pharmaceutical, biomedical analysis, genomics, speciation, proteomics, sample preparation, toxicology, metabolomics, terrorism, water, air, soil pollutants. 25 plenary lectures, 30 section lectures, 20 oral communications over 2 parallel sessions, and about 353 posters were presented in the frame of 11<sup>th</sup> ICCE. The integral part of the Congress have been the scientific workshops, exhibitions of equipment, accessories and publishers. According to the tradition, the Organizing Committee has also prepared an interesting cultural program. Everything has been done to present the gothic city of Toruń, the candidate for European Capital of Culture in 2016 and Kujawia-Pomerania Voivodeship.

Internationally reputed scientists have received Awards and Medals of the Polish Chemical Society: The Honorary Membership – Prof. Jean-Pierre Vairon; The Maria Skłodowska-Curie Medal – Prof. Jerzy Leszczyński; The Wiktor Kemula Medal – Prof. Jacek Namieśnik; The Jan Zawidzki Medal – Prof. Aleksander Koll; The Ignacy Mościcki Medal – Prof. Henryk Górecki; The Jan Harabaszewski Medal – Dr. Zofia Kluz. Also the Andrzej Waksmundzki Medal of the Committee of Analytical Chemistry of the Polish Academy of Sciences was given to Prof. Mietek Jaroniec and Prof. Tadeusz Paryjczak.

Concerning to the future of Polish Chemistry, the talented young scientists have been also awarded: Janikowa award – Agnieszka Kusior MSc.; Janikowa awards nominated: Emilia Objalska MSc., Monika Ludwiczak MSc., and Małgorzata Światłowska-Szczygieł MSc.; Kemula award – Dr. Żaneta Polkowska; Sigma- Aldrich & Polish Chemical Society award – Dr. Anna Michrowska; Sigma-Aldrich and Polish Chemical Society awards nominated: Dr. Anna Berlicka and Dr. Andrzej Gondela; Znatowicz award – Dr. Michał Bystrzejewski.

This special issue of the *Polish Journal of Chemistry* contains some papers from the wide spectrum of contributions presented during 50<sup>th</sup> Jubilee Congress of the Polish Chemical Society and Polish Association of Chemical Engineers.

As Guest Editor I would like to thank the contributing authors for their time and effort in preparing the papers published in the present volume. I encourage all the readers to serve as a timely, valuable source.

*Toruń, April 2008*

*Bogusław Buszewski*

## **Boron Hydrides in the Air of Work Environment**

by **A. Jeżewska<sup>1\*\*</sup>** and **B. Buszewski<sup>2</sup>**

<sup>1</sup>*Central Institute for Labour Protection – National Research Institute,  
Czerniakowska 16, 00-701 Warsaw, Poland*

<sup>2</sup>*Nicolaus Copernicus University, Faculty of Chemistry, Gagarina 7, 87-100 Toruń, Poland  
\*\*e-mail: anjez@ciop.pl*

*(Received September 12th 2007; revised manuscript August 25th, 2008;  
accepted September 8th, 2008)*

The paper presents information concerning physical, chemical and toxicological properties of diborane, pentaborane and decaborane. The methods of their synthesis and application are presented as well as the methods used to determine the concentration of these substances in the air.

**Key words:** diborane, pentaborane, decaborane, determination methods

## **Computer Simulation of Processes Connected with Electron Donor Fluorescence Quenching in Rigid Matrices. Effect of an External Electric Field**

by **M. Gutman and M. Hilczer**<sup>\*\*</sup>

*Institute of Applied Radiation Chemistry, Technical University of Łódź,  
Wróblewskiego 15, 93-590 Łódź, Poland, \*\*e-mail: m.hilczer@mitr.p.lodz.pl*

*(Received September 12th, 2007; revised manuscript March 14th, 2008;  
accepted July 5th, 2008)*

Computer simulation of photoexcited electron-donor  $D^*$  fluorescence quenching in a rigid matrix has been performed. Three processes are assumed to occur: (1) the natural decay of  $D^*$  excitation, (2) the electron transfer from  $D^*$  to acceptor  $A$ , (3) migration of the excitation energy among  $D$  molecules. The effect of an external electric field  $\mathbf{F}$  on process (2) has been included into considerations. Fluorescence decay curves calculated for various concentrations of  $D$  and the field-induced variation in the donor fluorescence intensity have been compared with respective experimental data and the results obtained from the approximate analytical calculations (*hopping model*).

**Key words:** photoinduced electron transfer, energy migration, simulation, hopping model, electric field effect

## Accurate Gas Phase Basicities of Hydroxyl Radical Modified Purines Estimated by Advanced Quantum Chemistry Methods

by P. Cysewski<sup>1,2\*\*</sup> and K. Kozłowska<sup>1</sup>

<sup>1</sup>*Department of Physical Chemistry, Collegium Medicum, Nicolaus Copernicus University, Kurpińskiego 5, 85-950 Bydgoszcz, Poland, \*\*e-mail: piotr.cysewski@cm.umk.pl*

<sup>2</sup>*General Chemistry Department, Faculty of Chemical Technology and Engineering, University of Technology and Life Sciences in Bydgoszcz, Seminaryjna 3, 85-326 Bydgoszcz, Poland*

*(Received September 12th, 2007; revised manuscript January 14th, 2008; accepted June 2nd, 2008)*

The gas phase basicities (GPB) of purines and their hydroxyl radical modified analogs were characterized by different methods and diverse basis sets. The macroscopic and microscopic protolytic properties of six derivatives were analyzed in details. Most of studied model purine analogs, namely 8-oxo-adenosine (AB), 8-oxo-guanosine (GA), xanthosine (GB) and fapy-guanosine (GC) have reduced basicities from 2.0 kcal/mol (AB) to 6.4 kcal/mol (GA) compared to non-modified model purine nucleosides. The fapy-adenosine (AC) and 2-OH-adenosine (AA) are characterized by higher basic character compared to non-modified adenosine. Besides, it is presented the detailed analysis of GPB inaccuracies estimated by means of HF, MP2, B3LYP, G3MP2 and G3MP2B3 methods. The B3LYP/aug-cc-pvdz approach seems to be the most accurate among studied methods and precise enough for estimation of GPB. However, the microscopic protonation features are much more sensitive to applied method since the difference in energies between some tautomers are often less than 1 kcal/mol with method dependent succession. The correct sequence of neutral and cationic forms may be however obtained using one of the model composite chemistry approaches, *e.g.* G3MP2B3. In the cases where B3LYP/aug-cc-pvdz and G3MP2B3 methods lead to contradictory predictions of order of neutral or protonated tautomers the latter is suggested to be used in the interpretation of microscopic protonation properties. Nevertheless, if only macroscopic property is necessary the B3LYP/aug-cc-pvdz level is sufficient since it provides GPB values with 1.0 kcal/mol accuracy.

**Key words:** gas phase basicity, protonation, hydroxyl radical, 2-OH-adenosine, 8-oxo-adenosine, fapy-adenosine, 8-oxo-guanosine, xanthosine, fapy-guanosine, purine bases, adenine, guanine

## Quantum Chemical Study of the Nature of Stacking Interactions of 2-Oxo-adenine with Native B-DNA Purines

by **Ż. Czyżnikowska, R. Zaleśny and P. Cysewski**\*\*

Department of Physical Chemistry, Collegium Medicum, Nicolaus Copernicus University,  
Kurpińskiego 5, 85-950 Bydgoszcz, Poland, \*\*e-mail: piotr.cysewski@cm.umk.pl

(Received September 12th, 2007; revised manuscript February 18th, 2008;  
accepted July 5th, 2008)

The scan of intermolecular interaction energy surfaces for stacked complexes of 2-oxo-adenine (AA) with purine bases was performed using the *density-fitting* approach at the MP2 level of theory with correlation-consistent Dunning's basis sets. Moreover, the convergence of stabilization energy to the basis-set limit was analyzed using two-point extrapolation formula proposed by Halkier *et al.* Four different complexes in two different context alignments appearing in B-DNA were considered, namely 5'-A/A-3', 5'-A/AA-3', 5'-AA/A-3', 5'-G/A-3', 5'-G/AA-3', 5'-A/G-3' and 5'-AA/G-3'. The results of *ab initio* calculation allow to arrive at conclusion that oxidation of adenine at C<sub>2</sub> position does not lead to significant changes in the structural parameters of stacked complexes. However, the modification of adenine by hydroxyl radical affects noticeably the stabilization energy only for 5'-G/AA-3' complex. In order to explain the source of this large stabilization effect, the intermolecular interaction energy decomposition was performed at the MP2/aug-cc-pVDZ level of theory for the minima on the interaction energy surfaces of adenine (2-oxo-adenine) with guanine. It was found that the observed larger stabilization energy for 5'-G/AA-3' compared to 5'-G/A-3' arises from the electrostatic interactions.

**Key words:** stacking, purines, modified nucleic acid bases, intermolecular interaction energy decomposition, density-fit

## Formation of Copper Selenide Layers on the Surface of Polyamide Films by the Use of Potassium Selenotrithionate

by R. Ivanauskas\*\* and V. Janickis

*Department of Inorganic Chemistry, Faculty of Chemical Technology,  
Kaunas University of Technology, Radvilenu str. 19, LT – 50254 Kaunas, Lithuania  
\*\*e-mail: remigijus.ivanauskas@ktu.lt; Ph: +37037 30 01 72; Fax: +37037 30 01 52*

*(Received September 12th, 2007; revised manuscript December 20th, 2007;  
accepted July 27th, 2008)*

The process and results of the formation of thin  $\text{Cu}_x\text{Se}$  layers on the polyamide 6 (PA) surface are described. For clarifying the influence of various factors (the concentration of the initial solution of potassium selenotrithionate,  $\text{K}_2\text{SeS}_2\text{O}_6$ , pH, seleniumization time and temperature) the kinetics of the sorption–diffusion of selenium into PA from freshly prepared solutions of potassium selenotrithionate was studied. The  $\text{Cu}_x\text{Se}$  layers of various composition are formed on the surface of polyamide film if the seleniumized polymer is treated with the aqueous solution of Cu(II/I) salt. The concentration of copper in  $\text{Cu}_x\text{Se}$  layers formed is strongly dependent on the initial conditions of seleniumization. Some structural properties and electrical resistance values of obtained layers have been also investigated. The three phases –  $\text{CuSe}_2$ ,  $\text{Cu}_2\text{Se}$  copper selenides and  $\text{Cu}_{2-x}\text{Se}$  *berzellianite* – in the  $\text{Cu}_x\text{Se}$  layers were identified. The  $\text{Cu}_x\text{Se}$  layers formed on PA have electrical sheet resistance in the range of 49.8 to  $2.5 \cdot 10^5 \Omega/\square$ .

**Key words:** selenotrithionate, polyamide, seleniumization, layers of copper selenide

## Novel Poly(etherimide)s with Attached NLO Moieties. I. Synthesis and Characterization

by E. Schab-Balcerzak\*\*

*Centre of Polymers and Carbon Materials, Polish Academy of Sciences,  
34 M. Curie-Skłodowska Str., 41-819 Zabrze, Poland  
\*\*e-mail: eschab-balcerzak@cmpw-pan.edu.pl*

*(Received September 12th, 2007; revised manuscript January 8th, 2008;  
accepted May 30th, 2008)*

Two types of novel poly(etherimide)s with attached photoresponsive azobenzene chromophores are presented. The polymers differing in the kind of linkage between the azobenzene units with the polymer chain, *i.e.* rigid and flexible, and in substituents on the chromophore moieties. The poly(etherimide)s with the rigidly incorporated the chromophores were synthesized from 4,4'-(4,4'-isopropylidenediphenoxy)bis(phthalic anhydride) and 2,4-diamino-4'-cyanoazobenzene and 2,4-diamino-4'-methylazobenzene. The polymers with the azobenzene chromophores, linked to the polymer backbone *via* long aliphatic spacers, were prepared from hydroxyl poly(etherimide) by the covalent bonding of new synthesized chromophores with the polymer backbone *via* the Mitsunobu reaction. The degree of functionalization of the poly(etherimide)s was estimated by UV-Vis and <sup>1</sup>H NMR spectroscopies. The NLO polymers exhibited high glass transition temperatures (150–214°C) and high thermal stability with decomposition temperatures in the range of 370–446°C. The resulting polymers possessed good solubilities in common organic solvents. A dichroism up to 0.19 was induced in a chosen new synthesized poly(etherimide) (**PEI 3**).

**Key words:** polyimides, nonlinear optical polymers, azobenzene chromophores, optical dichroism

## **Adsorption of Binary Mixtures of Organic (n-C<sub>6</sub>H<sub>12</sub> or C<sub>6</sub>H<sub>5</sub>Cl) and Water Vapours on Activated Carbon U-03 at 293 K**

**by R.M. Sobota\*\***

*Faculty of Chemistry, Technical University of Lodz, 90-924 Lodz, Zeromskiego 116, Poland*

*\*\*e-mail: radek.sobota@unine.ch*

*(Received September 12th, 2007; revised manuscript September 2nd, 2008;  
accepted September 17th, 2008)*

The adsorption of vapour and liquid mixtures of H<sub>2</sub>O + n-C<sub>6</sub>H<sub>12</sub> and H<sub>2</sub>O + C<sub>6</sub>H<sub>5</sub>Cl on activated carbon U-03 has been examined at room temperature 293 K. A model of Independent Co-adsorption proposed by Stoeckli *et al.* [1,2] leads to a good correlation between experimental and calculated mole fractions for each vapour in binary mixtures. This model can improve predicting dynamic systems such as breakthrough curves and PSA (Pressure Swing Adsorption). This model shows Independent Co-adsorption which can describe static or dynamic systems including breakthrough curves and PSA systems of binary immiscible vapour mixtures adsorbed by a typical industrial activated carbon U-03. The model assumes that vapours are adsorbed according to their respective Dubinin-Astakhov isotherms. A good mutual agreement was found between the calculated and experimental data.

**Key words:** binary mixture, QMS, activated carbon

## The Equilibrium of Phosphatidylcholine–Sphingomyelin in a Monolayer at the Air/Water Interface

by A.D. Petelska<sup>1</sup>, M. Naumowicz<sup>1</sup> and Z.A. Figaszewski<sup>1,2,\*\*</sup>

<sup>1</sup>*Institute of Chemistry, University of Białystok, Al. J. Piłsudskiego 11/4, 15-443 Białystok, Poland*

<sup>2</sup>*Laboratory of Electrochemical Power Sources, Faculty of Chemistry, University of Warsaw,  
Pasteur St. 1, 02-093 Warsaw, Poland*

*\*\*e-mail: elchem@uwb.edu.pl; phone: (+4885) 6647487; fax: (+4885) 6647489*

*(Received September 12th, 2007; revised manuscript December 12th, 2007;  
accepted July 5th, 2008)*

Monolayers of either phosphatidylcholine (PC) or sphingomyelin (SM) or their mixtures (PC-SM) were investigated at the air/water interface. The surface tension values of pure and mixed monolayers were used to calculate the  $\pi$ -A isotherms. The theory of equilibrium between components of monolayers at the air/water interface has been developed in order to obtain the stability constant of the PC-SM complex. We considered the equilibrium between PC, SM and the PC-SM complex on the basis of derived equations. We established that phosphatidylcholine and sphingomyelin formed a 1:1 complex, with the stability constant equal to  $K_{AB} = 3.20 \cdot 10^5 \text{ m}^2 \text{ mol}^{-1}$ .

**Key words:** phosphatidylcholine, sphingomyelin, monolayer, 1:1 complex

## **Solvent-Free Acrylic and Polyurethane Pressure-Sensitive Adhesives**

**by Z. Czech\*\* , M. Cieřlik, M. Wesolowska and M. Łagiewicz**

*Szczecin University of Technology, Institute for Chemical Organic Technology,  
K. Pułaskiego 10, 70-322 Szczecin, Poland, \*\*e-mail: psa\_czech@wp.pl*

*(Received September 12th, 2007; revised manuscript February 27th, 2008;  
accepted August 14th, 2008)*

Solvent-free acrylic and polyurethane pressure-sensitive adhesives (PSA) form very interesting new groups of polymers. The research and development of these polymers with self-adhesive properties is a quite interesting research field with full innovation and expected further exciting development in this area. Solvent-free acrylic and polyurethane PSA are still something of a speciality. They are photoreactive and UV-crosslinkable, and after crosslinking are characterized by sufficient thermal resistance, excellent moisture resistance and very good adhesion to wide range of typical surfaces.

**Key words:** solvent-free, acrylic PSA, polyurethane PSA, UV-crosslinking

## Synthesis and Cyclization of N-{2-[(2-Carboxyethyl)sulfanylphenyl]}-β-alanines

by K. Rutkauskas, K. Kantminienė and Z.J. Beresnevičius\*\*

*Faculty of Chemical Technology, Kaunas University of Technology,  
Radvilėnu st. 19, LT-50254 Kaunas, Lithuania*

\*\*e-mail: zigmuntas.beresnevičius@ktu.lt; Fax: +370 37 300 152; Ph: +370 37 300 151

*(Received September 12th, 2007; revised manuscript December 28th, 2007;  
accepted July 25th, 2008)*

The reaction of methyl- and methoxyaminobenzenethiols with acrylic acid resulted in formation of 8-methyl- and 8-methoxy-2,3-dihydro-1,5-benzothiazepin-4(5*H*)-ones, N-{2-[(2-carboxyethyl)sulfanyl]-4-methylphenyl}-β-alanine and 3-[(8-methoxy-4-oxo-3,4-dihydro-1,5-benzothiazepin-5(2*H*)-yl]propanoic acid. Their cyclization to N-(5-methyl-4-oxo-3,4-dihydro-2*H*-thiochromen-8-yl)-β-alanine, 5-methyl-9,10-dihydro-2*H*-thiopyrano[3,2-*h*]quinoline-4,7(3*H*,8*H*)-dione and 10-methyl-2,3,6,7-tetrahydro-4*H*,8*H*-[1,4]thiazepino[2,3,4-*ij*]quinoline-4,8-dione is described.

**Key words:** aminobenzenethiol, acrylic acid, benzothiazepinone, benzothiopyranylpropanoic acid, thiopyranoquinolinedione, cyclization

## Physicochemical Properties of Supported Cobalt Catalysts for Fischer – Tropsch Synthesis

by A. Michalak\*\*, K. Tomaszewska, M. Nowosielska and W.K. Józwiak

*Institute of General and Ecological Chemistry, Technical University of Łódź,*

*ul. Żeromskiego 116, 90-924 Łódź, Poland*

*\*\*e-mail: agnieszka\_michalak3@wp.pl*

*(Received September 12th, 2007; revised manuscript December 19th, 2007;*

*accepted July 26th, 2008)*

The physicochemical properties of cobalt dispersed catalysts (10–30 wt.% of Co) on supports (SiO<sub>2</sub>, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>) for Fischer – Tropsch synthesis have been investigated. The supported metal catalysts were prepared by the wet impregnation method. Catalysts and their precursors were characterized by thermogravimetric analysis coupled with mass spectrometer (TG-DTA-MS), BET and TPR methods. It was found that specific surface area of Co<sub>3</sub>O<sub>4</sub> supported on different supports SiO<sub>2</sub>, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub> decreased for all catalysts in function of increasing metal loading. The decomposition of catalysts precursor Co(NO<sub>3</sub>)<sub>2</sub>/support takes place according to three step process: dehydration, oxidative decomposition of cobalt(II) nitrate to Co<sub>3</sub>O<sub>4</sub> and high temperature reductive decomposition of Co<sub>3</sub>O<sub>4</sub> to CoO. Two-step hydrogen reduction of supported cobalt oxide phase occurs in the following sequence: Co<sub>3</sub>O<sub>4</sub> → CoO → Co.

**Key words:** Fischer – Tropsch synthesis, cobalt catalysts, TG-DTA-MS, BET, TPR

## **Study of the Surface Properties of the Hopcalite Modified with Noble Metals**

**by J. Rogowski, M.I. Szynkowska<sup>\*\*</sup>, A. Węglińska,  
E. Wojciechowska and T. Paryjczak**

*Institute of General and Ecological Chemistry, Technical University of Lodz,  
Zeromskiego 116, 90-924 Łódź, Poland, \*\* fax: (042) 631 31 28, e-mail: miszynk@p.lodz.pl*

*(Received September 12th, 2007; revised manuscript August 25th, 2008;  
accepted August 30th, 2008)*

In this work hopcalite-based catalysts, modified with noble metals, have been studied in oxidation of thiophene. It was shown that modified hopcalite displays higher activity for thiophene oxidation relative to commercial hopcalite. Moreover, differences in catalytic activity of hopcalite modified with different metals (Pt, Pd, Au) were observed. To explain these differences in catalyst activity both surface and bulk properties of catalyst were studied with Time of Flight Secondary Ion Mass Spectrometry (ToF-SIMS), Scanning Electron Microscopy with Energy Dispersive Spectrometer (SEM-EDS) and X-ray diffraction method (XRD). Au modified hopcalite shows the lowest activity for oxidation of thiophene. Obtained images of catalyst surfaces indicate that lowest Au modified catalysts activity is accompanied by pronounced non-homogeneous distribution of Au atoms on the catalyst surface.

**Key words:** catalytic oxidation, hopcalite, odour gases

## **Characterization of Au-Cu, and Au-Ni Spinel Supported Catalysts for Partial Oxidation of Methane and Methanol Synthesis**

by **T.P. Maniecki\*\***, **P. Mierczyński**, **K. Bawolak**, **D. Gebauer**,  
**W. Maniukiewicz** and **W.K. Józwiak**

*Institute of General and Ecological Chemistry, Technical University of Łódź,  
90-924 Łódź, Żeromskiego 116, Poland*

*\*\*fax: 48 42 631 31 26; e-mail: tmanieck@mail.p.lodz.pl*

*(Received September 12th, 2007; revised manuscript September 12th, 2008;  
accepted September 22nd, 2008)*

The aim of this work was the determination of the effect of support and gold promotion on physicochemical properties, and catalytic activity in partial oxidation of methane and methanol synthesis. The kind and amount of coke deposition formed during partial methane oxidation (POM) and methanol synthesis (MS) were determined. The influence of gold addition on physicochemical properties of mono- and bimetallic (Cu, Fe, Ni) spinel ( $\text{MgAl}_2\text{O}_4$ ,  $\text{FeAlO}_3$ ,  $\text{ZnAl}_2\text{O}_4$ ,  $\text{CrAl}_3\text{O}_6$ ) supported catalysts was determined. It was found that modification by gold-copper or nickel supported catalysts have no strong influence on their reducibility. Catalytic activity almost does not change before and after gold introduction for POM reaction and increases significantly for MS reaction. In both cases gold promotion decreases coke formation and makes easier its oxidation.

**Key words:** binary oxides, Ni-Au and Cu-Au catalysts, spinel

## **Methanol Synthesis from Mixture of CO, CO<sub>2</sub> and H<sub>2</sub> under Atmospheric Pressure over Au, Ag-Cu/FeAlO<sub>3</sub> Supported Catalysts**

by **T.P. Maniecki<sup>\*\*</sup>**, **P. Mierczyński**, **W. Maniukiewicz**, **K. Bawolak**,  
**D. Gebauer** and **W.K. Jóźwiak**

*Technical University of Łódź, Institute of General and Ecological Chemistry,  
90-924 Łódź, Zeromskiego 116, Poland, \*\*e-mail: tmanieck@p.lodz.pl*

*(Received September 12th, 2007; revised manuscript September 12th, 2008;  
accepted September 23rd, 2008)*

The influence of copper and noble metal (Ag, Au) addition on the physicochemical properties of support FeAlO<sub>3</sub> and supported metal catalysts was studied. The reaction of methanol formation in the temperature range 200–380°C under atmospheric pressure over a series of Cu and M-Cu catalysts (where M = Ag, Au) has been investigated. The presence of spinel like type structures FeAlO<sub>3</sub>, Fe<sub>2</sub>AlO<sub>4</sub> and FeAl<sub>2</sub>O<sub>4</sub> was confirmed by XRD technique. The physicochemical properties of supports and supported copper and bimetallic Ag, Au-Cu/FeAlO<sub>3</sub> catalysts were examined by BET, TPR, and XRD methods.

**Key words:** methanol synthesis, Ag-Cu/FeAlO<sub>3</sub>, Au-Cu/FeAlO<sub>3</sub>, bimetallic catalysts, FeAlO<sub>3</sub>, TPR-H<sub>2</sub>, copper catalysts

## **Gold as Promoter of Nickel Supported Catalysts for Semi Combustion of Methane**

by **T.P. Maniecki, K. Bawolak\*\***, **P. Mierczyński** and **W.K. Józwiak**

*Institute of General and Ecological Chemistry, Technical University of Lodz,  
90-924 Lodz, Zeromskiego 116, Poland*

*\*\* fax: 48 42 631 31 26; e-mail: kbawolak@p.lodz.pl*

*(Received September 12th, 2007; revised manuscript March 3rd, 2008;  
accepted August 13th, 2008)*

The gold influence on catalytic activity, stability and carbon deposition of supported nickel based catalysts was studied. The monometallic 5%Ni/Al<sub>2</sub>O<sub>3</sub> and bimetallic 5%Ni-x%Au/Al<sub>2</sub>O<sub>3</sub> (x = 2, 1, 0.5, 0.25, 0.1) systems were prepared by wet impregnation. The catalytic tests in partial oxidation of methane at 25–900°C and long term stability tests at 900°C during 24 h were carried out. The CH<sub>4</sub> dissociative decomposition and CO disproportionation processes were run at the same temperature range. Carbon deposition was studied by TG analysis and catalysts investigations by TPR and XRD measurements. The results indicated that gold addition improved both catalytic activity and resistance towards carbon deposition.

**Key words:** bimetallic catalysts, nickel, gold, synthesis gas