

# OLGA FOMINA

**A.E.Arbusov Institute of Organic and Physical Chemistry  
of the Russian Academy of Sciences**

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**Date of birth: February 2, 1988**

## GENERAL SUMMARY

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- **Research activity** has been started in 2008 in the laboratory of Organometallic Synthesis of A.E.Arbusov Institute of Organic and Physical Chemistry of Russian Academy of Sciences being student of the Chemical technology of organic substances of Department of the Kazan State Technological University.
- **Scientific interests:** chemistry of nickel complexes, phosphines, element and low-coordinated phosphorus, highly reactive organometallic and phosphorus intermediates, electroanalytical methods, electrochemistry etc.

## PROFESSIONAL EXPERIENCE

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### RESEARCHER

**02.2008 – 07.2010**

*Russian Academy of Sciences  
A.E.Arbusov Institute of Organic and Physical Chemistry  
Kazan, Russia*

### JUNIOR RESEARCH OFFICER

**09.2010 – present**

*Russian Academy of Sciences  
A.E.Arbusov Institute of Organic and Physical Chemistry  
Kazan, Russia*

### RESEARCH OFFICER

**04.2011 - 10.2012**

*Institute of Biochemistry  
Ernst-Moritz-Arndt-University of Greifswald  
Greifswald, Germany*

### ASSISTANT

**08.2016 - present**

*A.M. Butlerov Institute of Chemical  
KFU  
Kazan, Russia*

## EDUCATION

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**Student of the Kazan State Technological University  
(CHEMISTRY)**

**09.2005 - 06.2010**

*Kazan State Technological University  
Kazan, Russia*

**Bachelor. in CHEMICAL ENGINEERING AND BIOTECHNOLOGY 06. 2009***Kazan State University**Kazan, Russia**(Diploma of excellence, Bachelor)**Thesis titled: "Synthesis and properties of organonickel sigma-complexes with chelating nitrogen ligands"***M. Sc. in CHEMICAL TECHNOLOGY OF ORGANIC SUBSTANCES 06. 2010***Kazan State University**Kazan, Russia**(Diploma of excellence, Specialist)**Thesis titled: "Synthesis and magnetic properties of dinuclear organonickel complexes"***EXPERTISE**

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- Electroanalytical Chemistry
- Electrochemistry
- Electrosynthesis
- Inorganic Chemistry
- Organic Chemistry
- Organometallic Chemistry
- Catalytic Chemistry

**SPOKEN LANGUAGES**

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English – fluently

Deutsch –spoken

**PUBLICATIONS**

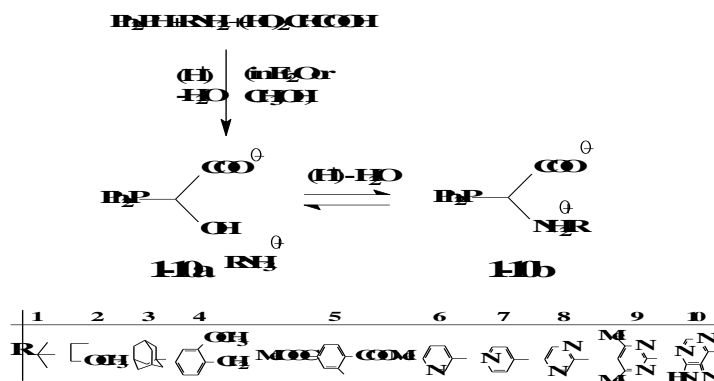
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1. Yakhvarov, D.G., Trofimova, E.A., Rizvanov, I.Kh., Fomina, O.S., Sinyashin, O.G. Electrochemical synthesis and catalytic activity of organonickel sigma-complexes. *Russian Journal of Electrochemistry*, **2011**, 47, 1100. DOI: 10.1134/S1023193511100247
2. Fomina O.S., Yakhvarov D.G., Heinicke J., Sinyashin O.G. Synthesis and catalytic activity of new N-substituted  $\alpha$ -diphenylphosphino- $\alpha$ -aminoacid // *Uchenye Zapiski Kazanskogo Universiteta*. **2012**, 154, 13. <http://dspace.kpfu.ru/xmlui/handle/net/26958>
3. Fomina O.S., Sinyashin O.G., Heinicke J., Yakhvarov D.G. Electrochemical properties of phosphinophenols and their esters – potential ligands for homogeneous processes of ethylene oligo- and polymerization // *Butlerov Communications*. **2012**, 10, 63. <http://butlerov.com/stat/reports/details.asp?lang=ru&id=10932>
4. Basvani, K., Fomina, O., Yakhvarov, D., Heinicke, J. Synthesis and properties of zwitterionic phosphonioglycolates. *Polyhedron*, **2014**, 67, 306. DOI: 10.1016/j.poly.2013.09.016
5. Aluri, B., Shah, K., Gupta, N., Fomina, O., Yakhvarov, D., Ghalib, M., Jones, P., Schulzke, C., Heinicke, J.  $\sigma$ 2P,O – hybrid ligands: Synthesis of the first 4-

- hydroxy-1,3-benzazaphospholes via ortholithiation of m-amidophenyl diethylphosphates. *Eur. J. Inorg. Chem.*, **2014**, 5958. DOI: 10.1002/ejic.201402527.
6. Ghalib, M., Lach, J., Fomina, O., Yakhvarov, D., Jones, P., Heinicke, J. Benzazaphospholine-2-carboxylic acids: Synthesis, structure and properties of heterocyclic phosphanyl amino acids *Polyhedron*. **2014**, 77, 10. <http://dx.doi.org/10.1016/j.poly.2014.03.046>
  7. Heinicke, J., Lach, J., Kockerling, M., Paim, G., Fomina, O., Yakhvarov, D., Sinyashin, O. Phosphinoglycines – Synthesis, Structure and Reactivity *Phosphorus Sulfur Silicon and the Related Elements*, **2015**, 190, 947. DOI: 10.1080/10426507.2014.984028
  8. Fomina O.S., kislitsyn Yu. A., Babaev V.M., Rizvanov I. Kh., Sinyashin O.G., Heinicke J.W., Yakhvarov D.G. Electrochemical properties and catalytic activity in the ethylene polymerization processes of nickel complexes with 2,2'-bipyridine in the presence of ortho-phosphinophenol derivatives. *Russian J. of Electrochemistry*, 2015, 51, 1069-1078, DOI:10.1134/S102319351511004X (eng)
  9. Fomina, O., Heinicke, J., Sinyashin, O., Yakhvarov, D. The synthesis of novel N-heterocyclic  $\alpha$ -diphenylphosphino glycines. *Phosphorus, Sulfur, and Silicon*, **2016**, 191,1478. DOI: <http://dx.doi.org/10.1080/10426507.2016.1212046>
  10. O. Fomina, J. Heinicke, D. Yakhvarov. Novel P<sup>O</sup>- chelating ligands in the nickel catalyzed oligomerization of ethylene. // *9th European Workshop on Phosphorus Chemistry (EWPC-9)*/ Rennes, France, March 22-23. **2012**. Book of Abstracts – P. 56.
  11. O. Fomina, J. Heinicke, D. Yakhvarov. Phosphoniumglycolates and/or phosphinoglycines: synthesis and conversion to nickel catalysts for ethylene oligomerization. // *Norddeutsches Doktorandenkolloquium 2012*/ Hannover, Germany, September 24-25. **2012**. Book of Abstracts – P.108.
  12. O. Fomina, D. Yakhvarov, O. Sinyashin, J. Heinicke. Novel  $\alpha,\alpha$ -phosphinoaminoacids: Synthesis, Properties and Catalytic Activity in the Ethylene Oligomerization Process// *EuropaCatXII – 2015*/ Kazan, Russia, August 30 – September 4. **2015**. Book of Abstracts – P.303.
  13. O. Fomina, D. Yakhvarov, O. Sinyashin, J. Heinicke. Novel catalysts for oligomerization of ethylene on the base of phosphorylation  $\alpha$ -amino acids.// *The I International School-conference of students, PhD students and young scientists "Biomedical, Materials and Technologies XXI Century"*, 2015 / Kazan, Russia, 25-28, November. **2015**. Book of Abstracts – P.577
  14. O. Fomina, J. Heinicke. O. Sinyashin, D. Yakhvarov, Novel N-substituted diphenylphosphinoglycines for ethylene oligomerization // *The 21st international conference on phosphorus chemistry 2016* / Kazan, Russia 5-14 June. **2016**, flash-presentation. Book of Abstracts – P.177.

Synthetic amino acids are of interest in various fields of chemistry, biochemistry and pharmacy. The first experiments with a phosphanyl group were obtained by condensation of natural amino acids with secondary phosphanes and formaldehyde, usually forming bis(phosphanylmethyl) amino acids, and studied with respect to their use as ligands in rhodium-catalysed hydrogenation reactions and in complexes for radio-diagnostics. The use of primary phosphanes extended the range of N-phosphanylmethyl amino acids to various P,N-heterocyclic types. The incorporation of P-alkyl instead of Pphenyl groups led to an increase in the sensitivity of Nalkyl- $\alpha$ -phosphanylglycines. To obtain more stable  $\alpha$ -phosphanyl amino acids we systematically varied the nitrogen substituents of the (diphenylphosphanyl)glycines and report here on the novel N-aryl derivatives **1**, their synthesis, structure and properties, and the first examples of their transitionmetal complexes and their use in homogeneous catalysis.

A three-component one-pot reaction of diphenylphosphine, primary amine and glyoxylic acid hydrate in diethyl ether or methanol allowed an easy access to N-monosubstituted diphenylphosphinoglycines **1b-10b**.



**Fig. 1.** Preparation of  $\alpha,\alpha$ -phosphinoaminoacids

The reaction of nickel (0) complexes with N-monosubstituted diphenylphosphinoglycines leads to the formation of a catalytically active form of the ethylene oligomerisation catalyst via oxidative addition to O-H or O-C bond of the used phosphorus ligand. The linear olefins with terminal methyl and vinyl groups are the main products of the catalytic ethylene oligomerisation process. The highest conversion of  $C_2H_4$  into linear  $\alpha$ -olefins was observed with *N*- $C_6H_3-2,5-(COOMe)_2$  phosphinoglycinate ligand **5b**. Since the conversion of ethylene with a nickel-based catalyst on the base of N-

(2-methoxybenzyl) diphenylphosphineglycine **4b** showed of conversion of ethylene about 75% of the preferential formation of hexene-1 (40%) and butene-1 (20%). Organonickel complex based on the base of N- (2-pyrazine) diphenylphosphineglycine **8b** to process about 96% of the loaded gas and analysis by gas chromatography showed 85% butene-1 in the condensed gas after catalyst reaction at the temperature about -25. The low part of the butene-1 was dissolved in the liquid oligomers .

Screening tests of the catalytic activity of the new phosphinoglycines in combination with complex  $[\text{Ni}^0(\text{COD})_2]$  (where COD= 1,5 cyclooctadiene) led likewise to oligo/polymerization of ethylene with high selectivity for linear products with methyl and vinyl end groups. We showed However, the catalytic process requires use of the special techniques operated in inert conditions due limited stability of  $[\text{Ni}^0(\text{COD})_2]$ . Moreover, this low stability of the metal complex precursor sometimes strongly limited a possibility of industrial application of the laboratory created catalytic systems based on the nickel complexes and P-C-C-O chelating ligands. Usually this problem can be solved by using of the chemical reducing reagents as NaH and others.

The aim of the research is to elaborated new processes of active nickel catalysts generation using electrochemical techniques. The generation of the active nickel catalysts will be performed by reaction of oxidative addition of synthesized new N-substituted  $\alpha$ -diphenylphosphino- $\alpha$ -aminoacids to the electrochemically generated nickel(0) complexes as in case of previously described organonickel sigma-bonded complexes.