

Dr. Andrew Solovyov

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HIGHLIGHTS

- Specialist in design, synthesis, and characterization of calixarene ligands for synthesis of advanced functional materials consisting of (i) grafted metal cations on inorganic oxide supports and (ii) chemisorption onto metal cluster surfaces
- Synthetic chemistry of phosphorus- and sulfur- containing macrocyclic compounds
- Development of synthetic methods for phosphorylation of calixarenes and resorcarenes
- Synthesis and investigation of stereochemistry and binding of metal cations and neutral organic molecules into artificial receptors based on calixarenes and resorcarenes
- Investigation of the self-assembly of calixarenes in solutions, colloid particles and thin solid films (LB films)

EDUCATION

Ph. D., Institute of Organic Chemistry, National Academy of Sciences, Kiev, Ukraine, June 2000
Thesis title: 'Calix[4]arenes possessing phosphoryl groups at the upper rim of the macrocycle'
Advisor: Professor Dr. Vitaly Kalchenko.
Diploma work, Organic Chemistry, Institute of Organic Chemistry, Kiev University, Ukraine, June 1995.
Advisor: Professor Dr. Vitaly Kalchenko.

RESEARCH EXPERIENCE

October 2008-present

Specialist, Chemical Engineering, University of California at Berkeley

February 2004 – September 2008

Post-Doc, Chemical Engineering, University of California at Berkeley

Advisor: Professor Alexander Katz

- Design, synthesis, and characterization of calixarenes as molecular building blocks for advanced functional materials

March 2003 – January 2004:

Post-Doc, Institute of Inorganic Chemistry, University of Bonn

December 2001 – February 2003:

Alexander von Humboldt Fellow, University of Bonn, Germany

Advisor: Professor Dr. Edgar Niecke

- Design and synthesis of new three-dimensional ligands of transition metals based on calix[4]arenes containing phosphinomethylene groups at the upper macrocyclic rim

October 1998 - January 1999:

Visiting researcher (INTAS cooperation) of the University of Parma, Italy

Advisor: Professor. Dr. Enrico Dalcanale

- Synthesis of amphiphilic phosphorous-bridged cavitands

November 1996 - November 1999:

Ph. D. student, Institute of Organic Chemistry, Kiev, Ukraine

Advisor: Prof. Dr. Vitaly Kalchenko

- Synthesis of calix[4]arenes containing phosphoryl, (-hydroxyphosphonyl, and (-aminophosphonyl groups at the upper rim
- Investigation of self-assembly of phosphorylated calixarenes
- Study of complexation of phosphorous-containing calixarenes with cations and neutral organics
- Cooperation with the Institute of Semiconductor Physics (Kiev, Ukraine) on calixarene-based sensors

□ Teaching of students in organic synthesis, NMR, and in preparation for their diploma works.

October 1992 - November 1996

Engineer-Chemist, Institute of Organic Chemistry, Kiev, Ukraine.

Advisor: Prof. Dr. Vitaly Kalchenko

September 1990 - June 1995:

Student, Shevchenko National University, Kiev, Ukraine.

Advisor: Prof. Dr. Vitaly Kalchenko.

- Experience in organic synthesis, especially in preparation of phosphorus containing organic reagents
- Synthesis and physico-chemical investigations of neutral organic molecule receptors based on calixarenes
- Extensive experience with NMR, UV, IR, and X-ray analysis

PERSONAL SCIENTIFIC GRANTS

1998 - Grant founded by President of Ukraine for Ph.D. students.

2001 - Humboldt Research Fellowship with Prof. E. Niecke, University of Bonn, Germany.

PROFESSIONAL AFFILIATIONS

Member of the American Chemical Society (ACS)

INTERNATIONAL PROJECTS

ISF Long-Term Research Grant Program (Soros Program) no. U6N000 and no. U6N200 “Synthesis and

Characterization of Self-Assembling Phosphorylated Calixarenes. Langmuir-Blodgett Films Formation and Molecular Recognition”.

INTAS Grant no. 94/1914 “Allosteric Ionophores”.

INTAS-UKRAINE Grant no. 95-0129 “Detection of the Organic Solvents Vapors Using Composite Thin Films

Based on Calixarenes and Conductive Polymers”.

INCO-COPERNICUS Grant no. IC15-CT98-0208 “Development of Technologies on Efficient Decontamination

of Radioactive Wastes Based on New Organophosphorus Ionophores”.

PUBLICATIONS: Articles and contributions to books

1. Shirshov, Y.M., Zynjo, S.A., Matsas, E.P., Beketov, G.V., Prokhorovich, A.V., Venger, E.F., Markovsky, L.N., Kalchenko, V.I., **Solovyov A.V.**, Merker R. (1997): Optical constants of thin films of calixarenes and their response to benzene and toluene adsorption. *Supramolecular Science* 4, 491-494.

2. Kalchenko, V.I., **Solovyov, A.V.**, Gladun, N.R., Shivanuk, A.N., Atamas, L.I., Pirozhenko, V.V., Markovsky, L.N., Lipkowski, J., Simonov, Yu. A. (1997): Inclusion compounds of oktakis(diphenoxyphosphoryloxy)- (tosyloxy)tetramethylcalix[4]resorcinolarenes and bis(diisopropoxyphosphoryl)dibenzo-18-crown-6 with benzene derivatives. *Supramolecular Chemistry* 8, 269-279.

3. Markovsky, L.N., Kalchenko, V.I., **Solovyov, A.V.**, Finocchiaro, P., Failla, S., Atamas, L.I., Consiglio, G., Tsymbal, I.F. (1998): Upper rim alpha-hydroxy- or alpha-amino phosphonic acid derivatives of calix[4]arenes. *Anales de Quimica* 94(3), 164-170.

4. Kalchenko, O.I., **Solovyov, A.V.**, Lipkowski, J., Kalchenko, V.I. (1999): Study of Complexation of Octakis- (diethoxyphosphoryloxy) tetramethylcalix[4]resorcinarene with Benzene Derivatives by RP HPLC Method. *Journal of Inclusion Phenomena* 34, 259-266.

5. Kalchenko, O.I., **Solovyov, A.V.**, Lipkowski, J., Kalchenko, V.I. (1999): RP HPLC Study of the Complexation of Benzene Derivatives Guest Molecules with 5,17-Bis(N- tolylmethylenimino)-25,27-dipropoxycalix[4]arene in Acetonitrile-Water Solution. *Journal of Chemical Research (S)*, 60-61.

6. **Solovyov, A.V.**, Atamas, L.I., Klimchuk, O.V., Rudzevich, V.L., Drapailo, A. B., Kalchenko, V.I., Varnek, A. A., Wipff, G. (2000): Ionophores Based on Calix[4]arenes Phosphorylated at the Upper Rim. Synthesis and molecular modeling studies. In: *Euradwaste 1999* 'Radioactive waste management strategies and issues', Ed. C. Davies. (Brussels:European Communities), 523-526.
7. **Solovyov, A.**, Cherenok, S., Tsybal, I., Failla, S., Consiglio, G., Finocchiaro, P., Kalchenko, V. (2001): Calix[4]arenes bearing \langle -amino- or \langle -hydroxyphosphonic acid fragments at the upper rim. *Heteroatom Chemistry*, 12, 58-67.
8. Houel, E., Lazar, A., Da Silva, E., Coleman, A.W., **Solovyov, A.**, Cherenok, S., Kalchenko, V. (2002): Interfacial Interactions of Cations with Amphiphilic dihydroxyphosphonylcalix-[4]-arene Mesosystems. *Langmuir*, 18, 1374-1379.
9. Kalchenko, O.,Poznanski, J.,Marcinowicz, A., Cherenok, S., **Solovyov, A.**, Zielenkiewicz, W., Kalchenko, V. (2003): Complexation of calix[4]arenes with uracil and adenine derivatives in water containing solution. *Journal of Physical Organic Chemistry*, 16, 1-7.
10. Kalchenko, O., Marcinowicz, A., Poznanski, J., Cherenok, S., **Solovyov, A.**, Zielenkiewicz, W., Kalchenko, V. (2005): Complexation of upper rim phosphorylated calix[4]arenes with uracil derivatives in water-containing solution. *Journal of Physical Organic Chemistry*, 18, 578-585.
11. Bass, J.D., **Solovyov, A.**, Pascall, A.J., Katz, A. (2006): Acid-Base Bifunctional and Dielectric Outer-Sphere Effects in Heterogeneous Catalysis: A Comparative Investigation of Model Primary Amine Catalysts. *Journal of the American Chemical Society*, 128, 3737-3747.
12. Notestein, J., **Solovyov, A.**, Andrini, L.R., Requejo, F.G., Katz, A., Iglesia, E. (2007): The Role of Outer-Sphere Surface Acidity in Alkene Epoxidation Catalyzed by Calixarene-Ti(IV) Complexes. *Journal of the American Chemical Society*, 129, 15585-15595.
13. **Solovyov, A.**, Amundsen, T.J., Daniels, J.J., Kim, Y-G., Katz, A. (2008): Primary Amine Confinement at the Interface of Grafted Calixarene and Silica, *Chemistry of Materials*, 20, 6316-6318.
14. **Solovyov, A.**, Notestein, J.M., Durkin, K.A., Katz, A. (2008): Graftable chiral ligands for surface organometallic materials: calixarene bearing asymmetric centers directly attached to the lower rim, *New.J.Chem.*, 32, 1314-1325.
15. Ha, J.-M., **Solovyov, A.**, Katz, A. (2009): Postsynthetic Modification of Gold Nanoparticles with Calix[4]arene Enantiomers: Origin of Chiral Surface Plasmon Resonance, *Langmuir*, 25, 153-158.
16. Ha, Jeong-Myeong; **Solovyov, Andrew**; Katz, Alexander (2009): Synthesis and Characterization of Accessible Metal Surfaces in Calixarene-Bound Gold Nanoparticles, *Langmuir*, 25(18), 10548-10553.
17. Kalchenko, O.I., Cherenok, S.O., **Solovyov, A.V.**, Kalchenko, V.I. (2009):Influence of Calixarenes on Chromatographic Separation of Benzene or Uracil Derivatives, *Chromatographia*, 70(5/6), 717-721.
18. de Silva, Namal; **Solovyov, Andrew**; Katz, Alexander (2010): Patterned metal polyhedra using calixarenes as organizational scaffolds: Ir₄-based cluster assemblies, *Dalton Transactions* 39(9), 2194-2197.
19. **Solovyov, Andrew**, Hollander, Fred, Katz, Alexander: Self-Assembly of long-chain calix[4]arenes and efficiency of their NO binding on reverse phase silica. in preparation.
20. **Solovyov, A.V**, Cherenok, O.I., Kalchenko, O.I., Atamas, L.I., Kazantseva, Z.I., Koshets, I.A., Tsybal, I.F., Kalchenko, V.I (2010): Synthesis and complexation of amphiphilic calix[4]arene

phosphonates with organic molecules in solutions and Langmuir-Blodgett films, *Journal of Molecular Liquids*, DOI: 10.1016/j.molliq.2010.12.007.

21. Ha, Jeong-Myeong; **Solovyov, Andrew**; Katz, Alexander (2010): Accessibility in Calix[8]arene - Bound Gold Nanoparticles: Crucial role of Induced-Fit Binding, *The Journal of Physical Chemistry C*, 114(38), 16060-16070.

22. de Silva, Namal; Ha, Jeong-Myeong, **Solovyov, Andrew**; Nigra, Michael; Ogino, Isao; W. Yeh, Sheilla, A. Durkin, Kathleen, Katz, Alexander. (2010): A Bioinspired Approach for Controlling Accessibility in Calix[4]arene-Bound Metal Cluster Catalysts, *Nature Chem.*, **2**, 1062-1068.

PARTIAL LIST OF PUBLISHED CONFERENCE PROCEEDINGS:

1. **Solovyov, A.**, Katz, A. (2005): Asymmetric organocatalytic synthesis of a new class of chiral calix[4]arenes, Pacificchem, Honolulu, U.S.A, December 2005.

2. Notestein, J., **Solovyov, A.**, De Siva, N., Iglesia, E., Katz, A. (2006): 461d grafted calixarenes for rational design and adsorbents. AIChE Annual Meeting, Conference Proceedings, San Francisco, CA, United States, Nov. 12-17, 461d/1-461d/2.

3. Notestein, J., Andrini, L.R., **Solovyov, A.**, De Silva, N., Requejo, F.G., Iglesia, E., Katz, A. (2007): Investigating effects of environment on heterogeneous Ti-catalyzed olefin epoxidation: inner- and outer-sphere ligand effects. Preprints – American Chemical Society, Division of Petroleum Chemistry, 52(2), 221-222.

4. Bass, J.D., **Solovyov, A.**, Daniels, J.J., Kim, Y-G., Katz, A. (2008): Outer-sphere control of heterogeneous aminocatalysis: Cooperativity and confinement, Abstracts of Papers, 235th ACS National Meeting, New Orleans, LA, United States, April 6-10, 2008.

5. Ha, J.-M., **Solovyov, A.**, Katz, A. (2009): Design and synthesis of accessible gold surfaces using calixarene-capped nanoparticles, Abstract of Papers, 237th ACS National Meeting, Salt Lake City, UT, United States, March 22-26.

6. de Silva, Namal; Ha, Jeong-Myeong; **Solovyov, Andrew**; Nigra, Michael; Luts, Tatiana; Kim, Yong-Gu; Katz, Alexander (2009): Synthesis and characterization of calixarene-capped heterogeneous catalysts. Abstracts of Papers, 238th ACS National Meeting, Washington, DC, United States, August 16-20.

7. de Silva, Namal; Katz, Alexander; Ha, Jeong-Myeong; **Solovyov, Andrew** (2010): On route to controlling heterogeneous catalysis with calixarene-bound metals. Abstracts of Papers, 239th ACS National Meeting, San Francisco, CA, United States, March 21-25.

8. **Solovyov, Andrew**, Ha, Jeong-Myeong; Katz, Alexander (2010): Calixarene-Based Assembly of Functional Nanomaterials: Chiral Gold Nanoparticles and Amines Confined in Chiral Pockets, Pacificchem 2010, Honolulu, U.S.A, December 2010.

PATENTS:

Solovyov, A., Katz, A., Iglesia, E. (2008): Bifunctional active sites for adsorption of nitrogen oxides from gas mixtures such as tobacco smoke. PCT Int. Appl., 60pp. (pending)

Katz, A., de Silva, N., **Solovyov, A.**, Ha, J.-M. (2009): Calixarene-Bound Gold Colloids Smaller than 3 nm and Consisting of Accessible Surfaces. (pending)

de Silva, N., **Solovyov, A.**, Chen, C., Kuperman, A., Katz, A. (2009): Calixarene-Bound Metal Ir₄ Clusters. (pending)