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PhD (Physical Chemistry), DSc (Chemical Physics)

# Senior Researcher

# Heterogenous Catalysis – Combustion Synthesis of Materials

##### Technology Transfer and Implementation

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**PERSONAL DETAILS**

Place of birth: Kustanay, Kazakhstan

Nationality: Hellenic

Languages: Russian: fluent (native language), English: fluent, Greek: fluent.

Previous Position: Chief Researcher and Head of SHS Catalysts and Pigments Laboratory, Combustion Problems Institute, Almaty, Kazakhstan (1984-1995).

**PROFESSIONAL POSITIONS**

* 1995 - present: Senior Researcher, Institute of Nanoscience and Nanotechnology, NCSR “Demokritos”, Aghia Paraskevi, Greece.
* 2015 – present: Invited Professor, Scientific Advisor of Laboratory of Catalytic Processes in Gas Turbines Construction, Samara State Aerospace University “S.P. Korolev”, Russia
* 2015-present: External Higher degree Supervisor , Coventry University, UK
* 2017: Visiting Professor, MISIS, Moscow Institute of Steel and Alloys.
* 1988-1996 Chief Researcher and Head of SHS-Catalysts and Pigments Laboratory, Combustion Problems Institute, Almaty, Kazakhstan.
* 1983-1996: Teaching Professor, Departments of Combustion and Catalysis and Engineering, Chemical Faculty, Kazakh State University.
* 1983-1988: Senior Researcher, Department of Catalysis and Technical Chemistry, Kazakh State University.
* 1976-1983: Senior Engineer, Department of Catalysis and Technical Chemistry, Kazakh State University.

**AWARDS:**

1. Russian Academy of Science (1997)

2. Russian Academy of Science (2007)

3. Combustion Problems Institute, Almaty, Kazakhstan (2011)

**EDUCATION**

- MSc Chemistry, Kazakh State University, 1976.

- PhD in Physical Chemistry, Kazakh State University and the Institute of Catalysis and Electrochemistry, awarded 1983 by the USSR Higher Degrees Attestation Commission on “Liquid Phase Oxidation of C3-C4 Olefins”.

- DSc in Chemical Physics, Institute of Structural Microkinetics, Moscow, awarded in 1992 by the Russian Higher Degrees Attestation Commission on “Self-Propagating High-Temperature Synthesis of Catalysts and Supports”.

#### RESEARCH ACTIVITIES

1. 40 years experience in Catalysis, Materials Science and Combustion synthesis processes.
2. World-wide pioneer developer of the new process: “Self-Propagating High-Temperature Synthesis (SHS) of Pigments, Catalysts, Carriers, light weight refractories and solution combustion synthesis of catalysts” with extensive industrial applications in Kazakhstan, Korea and Russia. Developed and managed pilot plants and industrial-scale plants for the production of SHS pigments, tiles in USSR, Kazakhstan, Russia and catalysts in South Korea, Taejon, LG Chemicals. Industrial application of high-temperature light-weight refractories for Buran-Zhukovskii, Russia and etc.
3. Over 350 publications and conference presentations, 40 patents.

Most important technological achievements:

* **Palladium catalysts** **on different carriers for** **oxidation of C3-C4 olefins** in liquid phase were produced by impregnation method. High yield of acrolein, methyl methacrylate, acrylic acid and methacrylic acid was achieved by variation of catalyst composition and conditions of oxidation (diluter type, temperature). Kinetic of reaction studied, it was found that reaction limited stage is diluting of oxygen in diluter. It is possible to produce in one stage methyl methacrylate with 98-99% selectivity. By electrochemical method it was found for the first time 2 types of adsorbed oxygen and that their ratio it is possible to change by diluter (PhD dissertation G. Xanthopoulou).
* **For the first time in the world detailed SHS and SCS (Solution Combustion synthesis) catalysts production technology developed**. Now at more 50 countries researchers follow those studies. Such interest to SHS catalyst can be explained by high activity of catalysts prepared by this methods and advantages of SHS method in comparison with traditional methods of preparation of catalysts. The main differences of SHS method for catalysts production in comparison with other methods of preparation of catalysts are: very high heating and cooling rates: 103 - 106 oC/sec, very short completion times, of the order of minutes which leads to formation of high defect structure responsible for high activity of SHS catalysts. Method is attractive for industrial production: much lower energy consumption than traditional production methods, much lower energy costs, possibility for “just-in-time” manufacturing, high productivity, cheap catalysts, relatively simple process - easily adaptable to industrial scale, controlled physico-chemical properties of the products, large range of new materials which can be used in catalysis, it has wide diapason of structural forms of products - from granules of different size to blocks of honeycomb structure and different geometric forms. SHS catalysts have low surface area (usually 0.5-5 m2) because of high combustion temperatures. The high catalytic activity at such low specific areas is related to both the SHS materials unique composition as well as their very high atomic defect concentration resulting from the SHS process conditions. Influence of initial batch composition, particle size of each material in the initial batch, binder concentration, pressure, drying conditions, preheating temperature and speed, initiation combustion conditions, velocity of combustion, temperature of combustion, time of cooling on the chemical composition, structure, physical properties and activity in different catalytic processes studied. The SHS method is being developed for the production of a new class of active catalyst materials based on metals, alloys, metal oxides, borides, carbides and spinels for various applications (DSc G. Xanthopoulou). In the case of heterogeneous spinel catalysts, it is well known that local distortions of the primary crystalline lattice act as active catalytic centers. The nature and extent of such distortions depends on the atomic radii of the lattice ions, the type and parameters of the crystalline lattice and atomic bonds, the size and dispersion of the crystallites, the size and nature of the dopant ions etc. In the case of spinel nanostructured catalysts for the oxygen reduction reaction, changes in the crystalline structure of the catalyst with decreasing particle size remains virtually unstudied. It was found that functionally significant, changes in the crystal lattice parameters of the active components of a spinel catalyst are usually caused by introducing various modifying additives, which increase the number of defects, but a comparable result can also be achieved by transition to the nanocrystalline state, in which the crystal lattice parameters change because of a sharp increase in the contribution of the surface forces and the necessity of balancing them. Actually, a decrease in the particle size of the active component may lead to either a desirable increase in the activity or to an abrupt decrease of it, which may also be caused by structural changes. This means that, for a particular catalyst and chemical process, there appears to exist an optimum amount of lattice distortion that gives high catalytic activity. Recent studies of nanostructured catalysts for various processes tend to confirm this observation. For example comparable studies of SHS and solution combustion catalysts show that decreasing particle size - giving significantly increased surface area - lead to negative result for carbon dioxide reforming of methane. It has also been observed that, for carbon monoxide oxidation, reducing nanoparticle size decreases the crystal lattice spacing and decreases activity of a cerium catalyst. The results indicate that, it may be possible to predict or “tune” the activity of a catalytic system for a particular process, by appropriate “design” of the crystal lattice. This could be done by adding specific ions which are known to produce the needed amount of distortion. SHS and, to a lesser extent, SCS, appear to be ideal techniques for this, since the materials synthesised by combustion synthesis are often metastable and the atomic lattice remains distorted after synthesis due to the rapid heating and cooling rates. This has become clear during studies of the mechanisms of spinel formation in the combustion wave, secondary structure formation in the process of further reaction of components and final structure formation in the process of cooling and is particularly noticeable in the formation of intermediate and non-stoichiometric compounds. The influence of the existence of distorted atomic lattice on catalytic activity has been studied for a number of spinel systems. By comparing the published data for SHS and SCS catalysts for various processes, it was possible to confirm the above conclusion and develop predictive criteria for the composition and atomic crystal structure giving the highest catalytic activity. Specifically, the trend of crystal lattice spacing was found to correlate with the trend of the length of the bonds of organic substances which must be adsorbed, broken on the catalyst surface and recombined with others for the synthesis of the reaction product. As a result, it is possible to “tune” the lattice spacing for maximum catalytic activity by doping the material with ions of appropriate radii, thereby distorting the crystal lattice by the correct amount. The above method for predicting and “tuning” the functionality of various spinels made by SHS is also applicable for spinel pigments. By the addition of appropriate dopants, it is possible to produce almost any colour and hue of the spinel-based pigments, as confirmed from the results of many years’ work on colour formation in SHS materials. Recently, new systematic studies of solution combustion synthesis of pigments confirm the applicability of this predictive method for synthesising a large variety of nano-structured pigments of various colours and hues by regulating the crystal lattice spacing and particle size. It was found that the major factors responsible for production of colour in specific spinel pigments, were the type (Co, Ni, Mn, Cr, Fe, Cd, Cu etc.), atomic size and structure of the dopant and the lattice position in which it enters, which decides the size and type of lattice distortion. The ionic radius of the dopant metal ion was found to be correlated to the wavelength of the reflected light from each pigment, i.e. the colour of the pigment. For example, in the system Co-M-O (where M is the metal ion), the wavelength of the reflected light was found to decrease monotonically with increasing ionic radius of dopant metal ion. It is expected that the above predictive process would be applicable to all types of functional spinels produced by SHS and SCS with ordered structure and composition. The spinel structure is fairy empty and flexible in the accommodation of non-stoichiometry, which is characterized by an excess of cations, located both tetrahedral and octahedral sites. Thus cations in the spinel structure can be substituted by many other cations to give multicomponent system, whose properties can be regulated by proper selection of the cations, appropriate adjustment of composition and structure, lattice parameters.

**SHS**

* **Pioneering studies on the mechanisms of structural formation during combustion synthesis**. Study of combustion wave structure of SHS systems was performed. Conditions for “freezing” combustion wave were found (PhD dissertation Gergienko V.). Mechanism of reactions and structure formation in different zones of combustions were discovered. For the first time clearly showed that, unlike the short-term processes in the combustion front (i.e. in the zone of chemical interaction), a slower process of the cooling and crystallization process (i.e. following the combustion front) is the main determinant of practical importance for physical properties of the target SHS products (this finding creates the basis for developing qualitatively new and effective SHS methods).
* **Development of SHS materials and processes for environmental protection**. It was found that without noble metals, SHS catalysts are very efficient at oxidising CO. SHS Cu-Cr-O catalysts were found to display better activity than palladium catalyst and achieve complete conversion at 250oC (PhD Dissertation of Pestina Olga), very active in this process also are also SCS catalysts (PhD dissertation of Novikov V.). This results are important for transport, chemical industry and power plants application. It is obvious that these SHS materials offer a great deal of promise as cost-effective catalysts for a variety of applications, possibly replacing traditional noble-metal systems. Very active SHS catalysts were developed for soot oxidation for diesel fuel transport application (soot in vehicle exhaust gases) (PhD Dissertation of Rodzivilov E). Also developed technology of active SHS and SCS catalysts preparation for CO2 utilization process: dry reforming of methane .
* **Thin layer and thin film combustion processes for coatings.** For number of compositions were found critical thickness for combustion in the SHS conditions. It was found that this thickness depends from thickness of support, from it’s material, from composition of the SHS batch. This data were used for joining of materials at different temperatures (PhD S.Gostev). It was found that with increasing of carrier thermal conductivity, decreasing of Al dispersity, critical thickness of layer increases.
* **Basic theoretical studies of interaction of SHS pigments with glazes**. Investigating of physic-chemical properties of glazes of different composition with SHS pigments on the base of vanadium system (PhD dissertation of Chernoglazova T). Segregation phenomenon during combustion in thing layer discovered. It was found that intermediate compositions of SHS and non equilibrium conditions of crystallization produce mable effect in thing layers.Developed new low temperature melted glazes for high speed production of ceramic tiles. Those glazes used in Uralsk plant.
* **Synthesis and Heat Treatment of Sprayed High Temperature NiAl–Ni3Al Coatings by In Flight Combustion Synthesis.** Combustion Assisted Flame SpraYing (CAFSY) of intermetallic coatings is a new, cost efficient and on site applicable thermal spraying process for applying Ni–Al intermetallic overlays or bond coats on metallic substrates for protection at high temperature(PhD dissertation A. Marinou). This is the synthesis of desired intermetallic phases in flight and in situ on the substrates during oxy-acetylene thermal spraying, using only low cost base metal powders. By adjusting the spraying conditions (initial composition, spraying distance, substrate temperature,and flame temperature), excellent Ni–Al based coatings have been produced on various substrates, including mild steel, stainless steel, and aluminum alloys. In some cases, however, the intermetallic phases formed on the substrates during CAFSY have been found to be metastable or the nickel and aluminum powders have not reacted sufficiently. In such cases, post spraying heat treatments of the coatings allow the solid state combustion reactions to proceed to completion in the coating. In many cases, it was found that increasing the temperature and the duration of the heat treatment increased the amount of intermetallic compounds (NiAl,Ni3Al, NiAl3, and Ni2Al3) in the coating up to as much as 90 vol %. In particular, all remaining aluminum reacts completely by forming Ni–Al intermetallics in the coatings. In all cases, porosity of the coatings remains below 3% while adhesion strength increases and reaches 57 MPa. The CAFSY method is a special manifestation of combustion synthesis, along the lines of the well known SHS method. Without the need for expensive pre alloyed intermetallic powders, optimization of spraying conditions allows very fast, in flight reactions between component base metal powders to produce the required coating alloys when they reach the surface of the substrate. The actual mixture of the intermetallic phases of the coatings and their properties can be optimized for any industrial use by controlling spraying conditions and composition of powder mixtures.
* **Synthesis by CAFSY method catalysts on carriers as new method of catalyst preparation.**  Combustion-assisted Flame Spraying (“CAFSY”) has been used to produce catalytic Ni-Al coatings on ceramic substrates. Their catalytic activity was studied in CO2 (dry) reforming of methane which is particular significance for environmental protection as well as production of synthesis gas. By varying the CAFSY processing parameters, it is possible to obtain a range of Ni-Al alloys with various ratios of catalytically active phases on the carrier, with a range of catalytic properties. The influence of the number of coating layers on the final catalyst composition and the influence of the type carrier on the catalytic activity of the CAFSY coatings was studied and presented here. The morphology and microstructure of the composite coatings were examined by scanning electron spectroscopy (SEM) with EDX elemental analysis, X-ray diffraction (XRD) and BET specific area analysis. The development of the various intermetallics on the surface was monitored by monitoring the relative peak heights of particular XRD peaks. Catalytic tests for dry reforming of methane were carried out using the coatings at temperatures 750°C - 900°C and chromatographic analysis showed that methane conversion approached 88% whereas that of carbon dioxide reached 100%. The hydrogen-to-carbon monoxide ratio in the syngas produced varied from about 0.7 to over 1.2, depending on the catalyst type and testing temperature.
* **World first 3d printed catalysts blocks also assisted by SHS and SCS**

For the first time in the world were designed and printed in 3D technique catalysts and carriers on the base of steel powder and Ni-Al alloys with concentration ratio calculated for: Ni3Al-13.2% Al, NiAl-31.4% Al, Ni2Al3- 40.7% Al and NiAl3 - 57.8% Al. Heat- transfer paths with intricate configuration and coplanar channels of the flow pass section

for heat transfer enhancement and extending of heat transfer surface were produced. In contrast to the internal combustion engine, for which the design of catalytic converters are well developed, in gas turbines units the main problem is to provide a minimum of hydraulic losses in the satisfactory performance of catalytic processes. The technology is put in heat-known scheme of coplanar channels, which provides high rates of heat transfer rate. One of fast prototyping directions is the technology of selective laser sintering (SLS), where the laser realized selective sintering of powder material by scanning a surface of a powder. First the article computer model received by a method of 3D- scanning or by direct computer modelling. Further the model under the set program is divided into layers of the certain thickness. An operating computer of 3D printer received information about each layer and regulates sintering according program until complete construction of article. As an energy source used the infra-red fiber laser (a source of electromagnetic radiation), by length of a wave of radiation 1075 nanometers, capacity 400 W with a cross-section direction of a laser beam distribution. From Ni-Al powders were prepared 3D blocks of coplanar channels structure and further they were placed in furnace for thermal treatment in SHS regime. For each sample were found optimum SHS synthesis conditions. 3D printed blocks were used as catalysts for partial methane oxidation, CO oxidation and methane combustion processes

* **Development of SHS catalysts for** **dehydrodimerization of methane.** The SHS method has been used to produce a range of active manganese-based catalysts for the oxidative dehydrodimerization of methane(for the production of ethane). Catalytic activity was measured at temperatures between 920 and 1120 K under a range of conditions. In the best case found, ethene yield was found to reach about 26% at a selectivity of 85% and methane conversion of 30.2%. Some ethane, propene, propane and hydrogen were also obtained. The addition of alkaline elements, promoted by halogenides, increased the yield of ethene at the expense of reduced stability. The catalytic activity was found to be enhanced by careful control of SHS conditions and various post-synthesis treatments of the materials (PhD dissertation of N.Sebryaeva). The scheme of reactions during SHS discovered, supplemented by X-ray photoelectron spectroscopy measurements, allowed for elucidation of the formation of the various products that appear in the synthesized material. The elemental composition of the surface of the catalysts as well as the valence of manganese (II or IV) in the catalysts was determined by X-ray Photoelectron Spectroscopy (KRATOS with MgKα and AlKα radiation) and by electron paramagnetic resonance (EPR). In the case of the materials made with 0.5% and 48.9% KMnO4 in the initial SHS charge, a comparison of surface species was made with the as-produced materials as well as after surface cleaning with Ar ion bombardment for 15 minutes. In the case of the materials made with 3.5% and 26.8% KMnO4 in the initial SHS charge, XPS and EPR analyses were carried out in the as-produced state as well as in the worked-out state. From these results a determination of the composition of oxides on the surface of the materials could be carried out (bulk catalyst composition determined by XRD was different from surface composition). The composition of the catalysts' surface is different in the four catalyst materials reported here. Manganese was found in all cases in the oxide (or spinel) form and the most active catalysts contain the greatest amount of Mn2+ in the form of MnO or MnAl2O4. However, after catalysis, the oxide is mostly MnO2. Analysis of the spectrum of Mn2p showed the presence of Mn2+ with Ebond = 641.0 ± 0.2 eV (probably as MnO and MnAl2O4) and Mn4+ with Ebond = 642.0 ± 0.2 eV. Decreasing of manganese content in the initial SHS charge increased the amount of Mn2+ in the surface layers. In the case of aluminum, XPS gave two forms with Ebond = 74.6 eV(dominating) and 72.0 eV. The first form is concomitant with the presence of Al2O3, whereas the second indicates the presence of metallic aluminum, probably as an intermetalide. In Mn-rich materials, the amount of the second (intermetallide) form on the surface decreased. After Ar doping, the near-surface (EPR analysis) or surface content of Al-containing intermetallic compounds remained approximately constant, or increased slightly. Increasing of the bonding energy of Al2p up to 73.4 eV in the richest Mn samples indicated that aluminates begin to form as Mn increases. In materials analyzed after catalytic reaction, the quantity of the intermetalic form of Al on the surface increased, something which can be attributed to reduction of Al2O3 by the presence of hydrogen in the product of reaction (PhD dissertation Yakoubova N.).
* **Synthesis and study SHS Co-Al-O catalyst activity in the synthesis gas combustion**(together with Institute of Catalysis in Novosibirsk, Russia)
* **Development of SHS catalysts for hydrogenation of olefins.** SHS catalyst on the base of Ni-Al alloys were produced and studied in the hydrogenation of olefins with double and triple bonds(PhD dissertation of E.Belozerova). Influence of composition and different synthesis parameters on the physico-chemical characteristics studied and found out, that SHS catalysts are more active than Ni –Raney.
* **Development of SHS catalysts for diesel fuel, petrol pyrolysis and dehydrogenation**. Chemical gases and liquids, such as ethene, ethane, propene, propane, benzene and toluene, are usually industrially produced from petrol (gasoline) or diesel. It as found, that increased porosity increases the yield of liquid products and coke but decreases the yield of ethane and other olefines. Coke formation is a serious problem with catalysts with small pores. Coke tends to clogg the entrance to small pores thereby quickly decreasing catalytic activity. In these cases, therefore, highly active catalysts with large pores and relatively small surface area are required to ensure high efficiency and effectiveness. SHS method offer simple way to regulate pores size and obtain low surface area catalysts with high specific activity. The substitution of Mg by Co in the Mg-Al- O spinel system deforms the structure changing slightly the crystal lattice parameters, depending on the amount of Co in the lattice, which can result in a significant number of lattice defects. The incorporation of Co in the spinel lattice resulted also in improved conversion efficiency. At 1020 K, the ethene production ratio with pure Mg-Al spinel was 23%, same as that for thermal pyrolysis, but this increased to 37% by the presence of a small percentage of Co. The sum of the ethene and propene yield was reaching 62 vol %. When Co was increased even further in the starting materials, excess oxide of Co appeared in the SHS product which changed the overall function of the catalyst to that of dehydrogenation with a H2 yield of up to 80%. Such enhanced hydrogen yield suppresses the possibility of ethene production, but this catalyst is very good for dehydrogenation process. Other results showed that, in general, the presence of Al2O3 in the catalyst resulted in a general decrease in the ethene yield whereas the presence of MgO. The catalytic activity of a mixed spinel material 0.6% CoAl2O4/99.4% MgAl2O4 was also compared with that of a commercial catalyst (KVO3 on a mullite/ corundum carrier) used in the production of ethene. The relative yield of ethene on the Co-containing spinel SHS catalysts was measured to be 38 vol% as compared to 28 vol% for the KVO3 catalyst. Furthermore, the coke accumulation on the SHS catalyst was on average 3.7 times lower than on the commercial catalysts(diesel fuel PhD dissertation Li D., petrol-PhD dissertation O. Volhonskaya).
* **Development of SHS catalysts for naphtha pyrolysis.** High yield of light olefins by catalytic pyrolysis of naphtha on spinel-based SHS catalysts is reported. The yields of ethylene and propylene reach over 50% and are at least 10% and 5% higher respectively than the yield using thermal Pyrolysis, under the same process conditions. The partial substitution of Mg by Co in MgAl2O4 and the incorporation of Al2O3, SiO2, MgO, H3BO3 in the spinel and SHS synthesis of KVO3 all increase the catalytic conversion efficiency while at the same time they suppress substantially the formation of coke. It was found that SHS-KVO3 catalytically accelerates the gasification of coke deposited on the catalyst surface and its optimum values were found to be more than 10 wt.%. The addition of B2O3 into the KVO3-based catalyst causes a strong interaction between KVO3 and SHS support, which decreases the loss by evaporation of the active phase. Catalysts behavior studied in pilot equipment in LG Chemicals.This catalysts used in LG Chemicals(Korea).
* **Development of SHS catalyst for methane reforming to synthesis gas and hydrocarbons.** Co-based catalysts were developed and their activity studied in partial oxidation of methane to synthesis gas. Two section reactor was build and kinetic of oxidation was studied (PhD dissertation Kaumenova G. N.).
* **Development of SHS catalyst for partial oxidation of methane to methanol.** Optimization of catalyst composition and conditions of process and study influence of these parameters on the yield of product (work was done together with Institute of Catalysis in Novosibirsk)
* **Recycling and exploitation of solid industrial wastes and rare materials by SHS – production of ceramic products.**

Industrial wasted of metallurgical, power plants, chemical plants production of Kazakhstan, Russia and Greece were studied and used for production ceramic tiles, wollastonite pigments and catalysts. For example chromate concentrate was used for pyrolysis of diesel fuel. It was found that coke formation was also significantly suppressed by the use of the SHS catalysts: 8% on average as compared to 16–19% for thermal pyrolysis. Up to a temperature of 920 K, the relative degree of coke formation between catalytic and thermal pyrolysis, varies from less than 0.1 to about 0.5 depending on the material. In most cases, the catalytic conversion efficiency decreases with increasing temperature. This is connected with the occurrence of destructive processes in higher temperatures which reduce the catalytic activity. The results also indicate that catalysts prepared by SHS from chromite concentrates possess higher catalytic activity (Cmax/Cthermal from 2 to 25) for low-molecular weight (<16) pyrolysis products. In this case, a strong tendency towards diminishing of the magnitude of Cmax/Cthermal with increasing molecular weight of pyrolysis products is observed. Therefore, these catalysts display enhanced dehydrogenation functions. This dependence of Cmax/Cthermal on is believed to be due to the fact that, with increasing molecular weight of pyrolysis products, the magnitude of their formation energy decreases(PhD dissertation A.Iskakova). Wastes of Greece:marble production, iron production and aluminium production were used for SHS pigment production.

SHS magnetic material were developed for cleaning of liquid contaminants on the surface of the water. The elaborated SHS method of immobilization of radioactive and chemically dangerous components spread in grounds was developed (together with ICP).

* **Development of SHS pigments.** For the first time were synthesised SHS pigments at about 1000 hues of colors. Studied their characteristics as pigments and characteristics of plastics, paints, ceramic, porceline, cosmetics with those pigments. All characteristics were also checked in different plants. Full animal tests (2 years animals study were done for SHS pigments). Catalogue of 1000 pigments hues was prepared. Catalogues of tiles with SHS pigmens+glaze (tiles and glaze of each plant we work with)were also made for each plant. It was found that those pigments can be used in industry (documents for tests attached in section 5). Production of these pigments started in 1991. For the first time color formation mechanism in SHS pigments determined.
* **Development of wollastonite pigments technology on the basis of phosphorus production wastes.** Wastes of phosphorus production contain significant concentration of wollastonite. Wollastonite pigments production technology was developed for wide range of colours and those pigments produced industrially. Wollastonite pigments properties studied and checked in industry where they received characteristics satisfying industrial requirements. This pigments used for production of plastics, paints, ceramic, and plasteline.
* **Development and study of SHS catalysts for deep methane oxidation** The process of catalytic methane oxidation is very important in industry as it is directly applicable to the purification of exhaust gases from a large spectrum of industries, vehicles, catalytic heat generators etc. The efficiency of catalytic oxidation of methane in exhaust gases can be enhanced if finely comminuted catalysts are dispersed on carriers with very high surface area in contact with the gas flow. The SHS materials studied include various compositions based on the systems Al-Mn-Mg-O, Mg-Cr-O, Mg-Al-O, Mg-Cr-Al-O and Cu-Cr-O with and without the addition of Cerium oxide and an epoxide additive as catalysts and as catalysts on SHS carriers (PhD dissertation Pestina O.). It is evident from the results that the most active catalysts for this process are those containing chromium and especially manganese (100% conversion of methane).
* **Development (for the first time) of SHS carriers of honeycomb structure by extrusion with further SHS.** Honeycomb-shaped blocks were manufactured by extrusion of the green powders and in-situ SHS and were found to satisfy most of the carrier requirements for mechanical properties, surface and to have good thermal stability.Influence of number of parameters were studied for optimisation of extrusion process, drying and SHS method parameters for receiving good quality carriers( PhD dissertation Kasymbekova D.)
* **Development of SiC/SiC ceramic composites by SHS for use in a Fusion Reactor.** SHS was successfully used to synthesize pure SiC. In the stoichiometric system 66.6%Si + 33.4%C (plus reaction additives) at a pre-heating temperature of 1500 C in air, the combustion temperature reaches well over 2500 C while the time of reaction can be as little as 1 minute. Composition, additives, SHS pre-heating temperature and pre-heating time all affect the yield and phase (hexagonal or rhombohedral or both) of the SiC produced. The use of pure Si and C as starting materials in stroichiometric composition (66.6%Si + 33.4%C) gave very promising results, especially if special additives are used. SiC was synthesized in both the rhombohedral and the hexagonal (high temperature) phases, by the use of suitable conditions and additives. The results also indicated that the system SiO2-C may offer even more promise than the Si-C system. The onset of SiC synthesis by SHS takes place earlier in the SiO2-C system than for Si-C. In the former, SiC synthesis begins at a pre-heating temperature of 550C and at 1500C yield reached 40%, wheres for the Si - C system the reaction starts at a pre-heating temperature of 1200 C and reaches 30% yield at 1500 C. Preliminary results show that the use of specific additives may increase the yield to 100% SiC at pre-heating temperatures significantly lower than 1500 C. SiC is synthesised in-situ between the parts SiC/SiC to be joined (under some pressure).
* **Bonding of materials by SHS method**. In joining, the SHS combustion wave is initiated at one edge of the bond and allowed to propagate between the two surfaces to be joined, which can be held in place under some pressure. As SHS can be taylored for many types of materials, the resulting joint can be made designed to be compatible with the materials joined. For example, to join SiCf/SiC materials, a bonding layer based on SiC would offer high compatibility. Bonding depends from composition of bonding SHS material, for example for the bonding system based on Al-Mn-Ti between SiCf/SiC specimens the shear strength about 30MPa, for bonding system Al-Fe-Mg- 50MPa.It was found that bonding strength by SHS depends also from thickness of layer, porosity, density, pressure, preheating temperature and many other parameters.

**SHS, High temperature materials technologies for Space applications:**

* **Hybrid thermal protection systems based on SHS ceramics for capsules and the “Buran Space Shuttle”.**

At about 300 tiles with required characteristics(working temperature 25000C,with density 0.5 g/cm3) were developed produced by SHS for “Buran” shuttle (USSR period), reactive bonding of high temperature ceramic (> 2500oC) (PhD dissertation of O.Dzhamanbekova).

* The need to develop new **Thermal Protective Systems (TPS)** for multiple entry usage has been recognized as being a significant challenge for most future planetary exploration missions. Later (in Greece). A novel hybrid thermal protection system with both passive and active characteristics which potentially offers capability for high heat-flux re-entry has been developed. “Hybrid TPS” consists of a porous MgO-based ceramic foam made by SHS filled with a phenolic ablator, providing significant synergy: the ceramic keeps the shape of the shield unchanged and the ablator protects the ceramic from melting by heat dissipation. The system has good mechanical strength and suffers only minor deformation and recession. The highly porous MgO-based framework for this SHS TPS is made by combining alumina, magnesia and a transient constituent which encourages the formation of open pores. Once formed the MgO-based framework is filled with low density phenolic reinforced with short ceramic fibres. Plasma-jet testing at up to 2.5MW/m2 heat flux has promising results. As designed, the HybridTPS offers the capability to delay the phonon (heat) wave for a sufficiently long period before it reaches the back surface. The nett areal density (at a total hybrid thickness of 25mm, equivalent of current ablators) ranges between 22 and 30kg/m2, increasing with ablator content, the higher densities offering higher heat-flux capability while the compressive strength reaches about 15MPa and the bending strength about 19MPa, far above other TPS systems
* **Refractories-TPS for Tupolev planes**

Refractories on the base of Mg-Al-O spinel +MgO were developed according to Tupolev construction buro requerements and produced 200 tiles(PhD dissertation Baymuhamedov E.).

* **In-situ synthesis of materials on the basis of Lunar or Martian simulant regolith** . There have been made several proposals for exploitation of lunar, such as production of materials from regolith for different application(construction materials, photovoltaics solar cells panel, refractories). It is planned to organize inhabitant lunar base. This demands selection of the proper materials and production of structural unit proper for working environment in lunar surface. For production of construction materials on the base of regolith can be used melted and ceramic products which keep shape after SHS. Melted products can be shaped by molding form. The properties of the produced ceramics are appropriate for a structure unit properties demands. Thus chromite and ilmenite(with olevine and without it) based SHS ceramic materials can be recommended for production of bricks for construction structural units on the Moon and Mars on the base of lunar and martian materials.

**SCS**

* **Development of Solution Combustion Synthesis (SCS) of nano-structured metals, alloys and inorganic catalysts and pigments.**  One of the new directions following SHS method is Solution combustion (SCS) synthesis, which is also very prospective for synthesis of catalysts, because it permits to produce catalysts with high surface area. By this method it is possible to produce catalysts (oxides, spinels, metals, alloys) on support which involves impregnation of reaction solution inside the porous structure of the inert solid support, followed by reaction initiation. This method permits synthesize of supported catalyst or catalyst in powder with extremely high surface areas (up to 200m2 g−1). By SCS were produced active catalysts for dry reforming of methane, hydrogenation, CO and soot oxidation and others. A wide range of SCS pigments, nano alloys and nanometals were produced and studied.
* **Influence of atomic structure on the nano- nickel-based catalysts activity produced by Solution Combustion Synthesis in the hydrogenation of unsaturated compounds.** Nano-structured nickel-based catalysts have been synthesized by SCS and it has been found that their physical properties and atomic structure depend in a complex way on the parameters of SCS processing, especially the amount of water used in the initial solution. The catalysts were characterised by XRD, BET and GC-IRF and their catalytic activity has been determined for hydrogenation of maleic acid. Various mechanisms (especially at the atomic-level) are active during these materials synthesis which critically influence their catalytic properties, often in opposing ways. Hydrogen adsorption studies have helped to clarify the main mechanisms involved. Specifically, it was determined that nickel oxide acts as a carrier for nano-structured metallic nickel in the absence of which the catalyst almost deactivates. Understanding the interrelationships between the processing parameters and the ensuing atomic structure has allowed a degree of optimization of the catalytic properties of the new catalysts (PhD dissertation O. Thoda). There are strong indications that the effect of the strength of the initial aqueous solution may be relevant for other catalytic synthesis processes which use aqueous solutions of salts, such as impregnation, precipitation, sol-gel and other methods and which employ further thermal treatments during synthesis. This work shows for the first time, that compounds, such as hydrates, which form in solution appear to persist even after all the water has evaporated and influence the physico-chemical properties of the products formed during later stages. This apparent "memory effect" exists even during the later sintering stages and may explain many of the difficulties reported in repeating synthesis results since the strength of the initial aqueous solution is generally not taken into consideration during analysis of catalytic synthesis.
* **Development of SCS and SHS catalyst for CO2 dry reforming of methane.**

The catalytic activity of SHS\_produced cobalt–alumina, Ni-Mn-O,Ni-Al, Ni-Co-O and other systems catalysts for dry (carbon dioxide) reforming of methane were studied. The catalysts were prepared from powder mixtures(SHS) or in solvent (SCS) at several processing conditions. XRD data, Fourier transform IR spectra, and SEM–EDS data suggest that the catalysts consisted predominantly of spinel and mixed oxides but with a strongly distorted atomic structure. Catalytic tests for dry reforming of methane to produce syngas were carried out at temperatures 700- 900°C and chromatographic analysis showed that carbon dioxide conversion approached 100% whereas conversion of methane reached 100%. The hydrogen to carbon monoxide ratio in the syngas produced varied from about 1.1 to over 2, depending on material and testing temperature (PhD dissertation of K.Karanasios).

* Ceramic **hollow spheres** as carries for SCS catalysts.Ceramic hollow spheres could be formed by sintering of spherical organic template covered with a mixture of ceramic powders and binder. Smaller ceramic powders formed with a milling process attained the coating of the mixture homogeneously, and higher viscous binder could stabilize a spherical shape of ceramic hollow spheres. Size, thickness and porosity which are primary structure and affect the characteristic of ceramic hollow spheres were found to be varied with binder type, binder weight ratio, weight ratio of ceramic powders and organic template and sintering temperature. Those ceramic hollow spheres were impregnated by initial mixture for SCS and treated at different temperatures. A range of SCS catalysts on hollow spheres were produced and studied in process of dry reforming of methane (PhD dissertation of M.Matsuda)
* **SCS nanopigments**.Wide range of SCS pigments of different colors were produced and thir properties studied for application in paints, ceramic , paper and plastic .
* **Luminescent SCS.** Luminescent SCS nanopigments produced of wide range of colors and color characteristics(including luminescent characteristics) studied and pigments were used for ink for paper and silk.

**INDUSTRIAL ACTIVITIES**

1. Palladium nano-catalysts for liquid phase oxidation of isobutylene to methylmethacrilate (for production of bullet prove glass) were tested in pilot plant in Dzerzhinsk secret organization p/y234, Russia in 1981 on the base of project“Liquid Phase Oxidation of Isobutylene to Methacrylic Acid on Palladium Catalysts”, USSR Program on industrial R&D, 1977-1981
2. ”The Development of Heat-insulation Shild of High-temperature Heating Block for Heating to Temperatures 1900-2000C”, Report, contract with secrecy with Central aerodynamic Institute named N.E. Zhukovskii (ЦАГИ-TSAGI) - space shuttle Buran, State Registration N01900031159, Inv.N02900044265, Moscow (USSR),1986-1988,p.1-66. (equal in value 1 500 000 Euro). **300 of SHS high-temperature, light weight tiles size 24x24 cm with complicate form were produced and delivered for space shuttle in 1988.**
3. ”Development of high-temperature ceramic structure for the forward edge of flying apparatus”, contract with secrecy with “Tupolev”, Design buro for Tu-204 and for supersonic crafts“, Report Number of State Registration 01900045282, Inv.N 02920056665, Moscow(USSR),1988-1989, p.1-127 **Tiles were produced and delivered to Tupolev design Buro in 1989.**
4. **High temperature SHS refractories** passed tests in Podolsk refractory plant **1990.**
5. Full scale (2 years) animals study of SHS pigments for cosmetics, 1990-1991 USSR Institute of Cosmetics
6. Developed (from start) and managed plant in industrial-scale for the **production of SHS pigments (1 tonne per day)**, Almaty, Kazakhstan and in Moscow region 1993-1996. Pigments were tested in different glazes for tiles and sold in ceramic plants of Moscow (Russia), Kislovodsk (Russia), Uralsk (Kazakhstan), Almaty (Kazakhstan), for glazes for porcelain Kapchagai (Kazakhstan), for plastics-polypropylene, polyethylene, polystyrene on different plants of USSR and were sold to those plants.
7. Developed (from start) and managed plant in industrial-scale (production facility 45000 per month) for the **production of SHS tiles with SHS glazes**, Almaty, Kazakhstan 1994-1996
8. **Production (1995) of wollastonite pigments** in Moscow Region-industrial application, on the base of project “Synthesis of Pigments on the Basis of Raw Wollastonites for Multiple applications and Study of Their Physicochemical Properties”, Final Research Report, State Registration N 0194RK00663, Inv. N0294RK00045, Almaty (Kazakhstan), 1994, p.1-39
9. **Pilot study of Co-based SHS catalysts in the process of pyrolysis diesel fuel** in the Soviet Union institute of Organic synthesis 1995 on the base of project “Synthesis of Metal-Ceramic Catalysts by SHS-method for the Process of Pyrolysis, Hydrogenation and Oxidation”, Final Research Report, State Registration N 0194RK00892, Inv. N0294 RK 00050, Almaty (Kazakhstan), 1994-1995, p.1-54
10. Work with plants of USSR, Kazakhstan, Russia for application of SHS pigments for glazes for production of ceramic tiles, for plastic (Polyethylene, polypropylene, polyvinyl) production, development of new glazes with SHS pigments **- project leader 1991-1995**
11. Developed technology for Uralsk plant in industrial-scale for **production ceramic tiles** on the base of local clay, Uralsk, Kazakhstan, 1994-1995on the base of industrial project“Development of Manufacture Technology of Ceramic Tiles for Internal Wall Facing on the Basis of Raw Materials Resources of Ural Region and Wastes of Production“, Report, State Registration N 0194RK00666, Inv.N0294RK00048, Almaty (Kazakhstan), 1994, p.1-66
12. Developed **catalysts for pyrolysis of naphtha**, passed pilot plant scale tests and applied for industrial-scale plant for the production in South Korea, Taejon, LG Chemicals.1999-2001
13. PRAXE A “Spin-off support programme, Stage A”, GSRT, Greece, GALEXIC A.E. company, 2002-2003 (50 000Euro).

#### ACADEMIC ACTIVITIES

* Full Professor responsible for Combustion Processes and Catalysis, Department of Chemical Physics and at the Department of Catalysis and Chemical Technology, Kazakh State University, Almaty, Kazakhstan, 1976-1995.
* Supervision of about 200 students (BSc, MSc and PhD) in USSR, Kazakhstan and Greece.
* External Higher Degree Supervisor of Coventry University, UK, 1999, 2015-2016.
* Member of Scientific Committee for “Chemical Physics and Physical Chemistry”, PhD and DSc Degrees, Kazakhstan, Almaty, 1991-1996
* Member of Scientific Committee for “Catalysis” for PhD and DSc Degrees, Kazakhstan, Almaty. 1991-1996
* Chairperson of 11th SHS International Symposium on SHS, 5-9 of September 2011, Anavissos, Greece <http://web.ims.demokritos.gr/SHS2011/>
* Member of Organizing Committee of Int. SHS Symposium, Almaty 1991.
* Member of International Advisory Board of the Int. SHS Symposia: 2001, 2007, 2009, 2011, 2013, 2015, 2017.
* Member of International Advisory Board of the Int. CIMTEC Conference, 2010
* Member of Organizing Committee, 3rd Planetary Probe Workshop, Anavyssos, 2005
* Numerous seminars and Colloquia on SHS, SCS, catalysis and functional ceramic materials.
* Member of Editorial board of “SHS Journal”, “Eurasian Chemico-Technological Journal”, Science of Central Asia”(2010-2017) , Russian Journal of Non-Ferrous Metals (2017-).
* Reviewer of submitted manuscripts for the International Journals “Journal of Materials Science”, “Industrial and Engineering Chemistry Research” of the American Chemical Society, “Chemical Engineering & Technology”, “Journal of Modern Physics B”, for International Journal “Environmental Science & Technology”, for “Journal Ceramics International”, “Journal Results in Physics”, for Slovak Research and Development Agency , national funding agency, “Journal of Alloys and Compounds”, “Chemical Engineering Journal “, AIChE Journal, The European Physical Journal - Applied Physics (EPJ AP), “Chemical Engineering Science “, “Chemical Engineering Journal”, “Ceramics International”, “High Temperature Materials and Processes”, “[Journal of Materials Processing Technology](https://ees.elsevier.com/ceri/mainpage-con.asp)”, “Catalysis Today”, “Journal of Environmental Chemical Engineering” and etc .
* Reviewer of book G.F.Tavadze, A,S, Shteinberg“Production of SHS materials”, 2011, Publisher “Meridian”, 206 pages

#### CONSULTING ACTIVITIES

* 2000-2014 Expert Evaluator for European Commission Proposals in the Programmes Growth and FP6, FP7 (Marie Curie, Individual Marie Sklodowska Curie - RISE 2014,STREP, NEST, SME, NOE), H2020, **H2020-FETOPEN-1-2016-2017-RIA\_11-05-2016** of the European Commission. Evaluations included technical, economic and socio-economic impact.
* **1999-2016 Consultant to European Commission**. Project EVIMP evaluator of completed projects (after their finalizing and after few years after finalizing of projects in order to find out how efficient was fulfilling of tasks and their application in industry) within the European Commission Programmes BRITE/EURAM, IMT, CRAFT, SMT and M&T, SMEpact evaluator of completed projects within EC Programmes IST, EESD-ENERGY, GROWTH, STREP, QoL, SME-pact, **Horizon2020-MSCA-RISE-2014,** SPACE - Monitors - January 2015 to January 2016, H2020-FETOPEN-2016-2017.
* 2007-2008 **Reviewer of ITTE** (International Technology Transfer Expertise – Best Practices), for the European Commission with visiting different organizations of European countries, analyzing there work and reporting best practice in application results of EC projects in industry.
* **Reviewer of following EC projects:**

 **2015** Project LIGHT-TPS 607182 - Super Light-Weight thermal protection system for space application (project 2014-1015) 7th Framework Programme for Research (FP7)

**2016** Project“Design and Fabrication of Functional Surfaces with Controllable Wettability, Adhesion and Reflectivity(FabSurfWAR 644971)” of the Marie Skłodowska-Curie Actions: Research and Innovation Staff Exchange (RISE)

* 1987-1996: Senior Advisor to the Ministry of Education and Ministry of Research and Development, Government of Kazakhstan. Member of Committee on the Assessment of Exploitation of Research Results of Government Laboratories – Sub-Committee on setting up of Industrial Enterprises (spin-offs) based in Government Laboratories Research Results. Carried out many evaluations of proposals and finished projects funded by these Ministries. Evaluations included aspects such as: methodology, technical and economic feasibility, relevance to local or national needs, techno-economic viability, socio-economic and environmental impact, impact on local economy, viability of business plan, availability and viability of financial backing, ability and expertise of personnel etc.
* 1989-1991 Senior advisor to the Committee “Methane conversion” of Ministry of Industry of Soviet Union
* 1991-1996 Consultant and advisor for start-up industries based on R&D results (spin-offs). Follow-up studies of spin-off companies and technological and managerial support. Co-management of two spin-off companies in Almaty, Kazakhstan producing Ceramic SHS Pigments and Ceramic SHS Tiles. SHS pigments technology also was used in Moscow pigment plant.
* 1993-1994 developed wollastonite pigments production technology (used in Egorievsk, Moscow region plant.
* 2000-2001 Developed SHS catalysts for pyrolysis naphtha industrially applied in LG Chemicals, South Korea.
* 1995 Ceramic tiles on the base of local resources developed technology applied in Uralsk ceramic tiles plant (Kazakhstan).
* 1986-1996 Intellectual Property Protection Advisor, Combustion Problems Institute, patents and other means of protection of technological results, Kazakhstan.
* 1988-1996 Scientific Consultant for ceramics and chemical engineering companies in USSR, Kazakhstan, Greece, Korea and Russian Federation. Assessment of optimum technological level, technological auditing, technology transfer and technology implementation studies.
* 2006-2007 Member of working group of “Hellenic FORESIGHT 2022”

**R+D PROJECTS**

Extensive research experience as project leader of many industrial projects for the development of new industrial processes and materials in Chemical Engineering.

Responsible for various research projects for industrial, scientific and military R&D projects in Kazakhstan, and Greece (for example contract with Tupolev construction corporation, Russian and ESA space agencies, Russian tank engines institute, Dzerzhinsk Military organization).

**SCIENTIFIC AND INDUSTRIAL PROJECTS, REPORTS PUBLISHED IN USSR and KAZAKHSTAN** (all reports are confidential or strategic with restricted publication)

1. G.Gladoun-Xanthopoulou, V.A.Druz, “Liquid Phase Oxidation of Isobutylene to Methacrylic Acid on Palladium Catalysts”, USSR Program on industrial R&D, 1977-1981, (published in Russian). (equal in value 40000 Euro) **- project co-leader**
2. G.Gladoun-Xanthopoulou, V.A.Druz, Z.N.Novikova Liquid Phase Oxidation of Propylene to Acrylic Acid and Propionic Aldehyde on Palladium Catalysts, USSR Program on industrial R&D, 1982-1984, (equal in value 60000 Euro) **- project co-leader**
3. G.Gladoun-G.Xanthopoulou, A.Z. Iskakova,Zh.Orynbekova, O.Dzhamanbekova, O.Volhonskaya “Exploratory Investigation of Motor Fuel Pyrolysis Processes for Application to Transport Motors”, Finance source: Defence ministry, Institute of engines(tanks), Moscow, contract with secrecy, State Registration N02870040551, USSR Programme on industrial R&D, 1985-1986, (published in Russian) (equal in value 400000 Euro**) - project leader**
4. G.Gladoun-Xanthopoulou, N.Gutsaluc, D.Kasymbekova, J.Li, O. Volhonskaya and E.Belozerova. “Development of catalysts of liquid hydrocarbons fuels thermal decomposition on the basis of SHS-compositions”, Finance source: Defence ministry,(Dzerzhinsk secret org.-bombs) Report, contract with secrecy, State Registration N 01870077136, Inv. N 02890036655,Moscow(USSR), 1985-1988, p.1- 92 (equal in value 200000 Euro) **- project leader**.
5. G.Gladoun-Xanthopoulou, D.Kasymbekova, R.Abdulkarimova, E.Belozerova, O. Volhonskaya E.Belozerova, Zh.Orynbekova, O.Dzhamanbekova,T.Dmitrieva, T.Kyrykbaev,U.Kushtaev,B.Baimuhamedov, A. Tashmetov, O.Pestina, I.Susura, A.Baitugulov, A.Paramonov, V.Sergienko, L.Astapenkova, ”The Development of Heat-insulation Shield of High-temperature Heating Block for Heating to Temperatures 1900-2000C”, Report, contract with secrecy with Central aerodynamic Institute named N.E. Zhukovskii (ЦАГИ-TSAGI) - space shuttle Buran, State Registration N01900031159, Inv.N02900044265, Moscow (USSR),1986-1988,p.1-66. (equivalent in value 1 500 000 Euro) **- project leader.**
6. G.Gladoun-Xanthopoulou, R.G.Abdulkarimova, O.A.Dzhamanbekova, U.B.Kushtaev, E.H.Baimuhamedov, D.Kasymbekova, V.Sergienko, D.A.Dzhankoulov, A.P.Paramonov, N.S.Litvinova. ”Development of high-temperature ceramic structure for the forward edge of flying apparatus”, contract with secrecy with “Tupolev”, Design buro for Tu-204 and for supersonic crafts“, Report Number of State Registration 01900045282, Inv.N 02920056665, Moscow(USSR),1988-1989, p.1-127 (equal in value 1 000 000 Euro) **-project leader.**
7. G.Gladoun-Xanthopoulou, D.Kasymbekova, I.Li, E.Belozerova, N.Yakubova, L.Astapenkova, D.Dzhankulov. “Self-propagating high- temperature synthesis of catalysts and supports”, Report, Number State Registration N 01900029109, contract with secrecy with MNTTS SHS , Moscow(USSR), 1989-1992, p.1-151(equal in value 450 000 Euro) **Xanthopoulou G.-project leader**
8. G.Gladoun-Xanthopoulou, E.Belozerova, D.Kasymbekova, O.Volhonskaya, N.R.Yakoubova, A.Z.Iskakova, L.V.Astapenkova, Zh.Li, L.A.Poryadina, O.A.Dzhamanbekova, M.Toultaeva, T.E. Dmitrieva, T.S.Kyrykbaev, U.B.Kushtaev, B.H.Baimouhamedov, V.A.Sergienko, D.A.Dzhankoulov, N.S.Litvinova, I.A.Hlystov, A.A.Papst, Z.L.Andrianova, I.A.Sheveleva, A.N.Starodubtsev, A.A. Shirinhanov. “Investigation of physico-chemical properties of catalysts on the base of nickel, received magnesium, iron oxides by SHS-method”, Report, Number of State Registration 01900059622, Inv.N 02920000188, contract with secrecy with ISMAN Moscow(USSR),1992-1993, p.1-161(equal in value 50 000Euro) **- project leader**
9. G.Gladoun-Xanthopoulou, T.Chernoglazova, Kruglova, L.Ilchenko and A.Iskakova “Development of New Reception Technology of Coloured Glasses and Artificial Stones“, Final Research Report, State Registration N 0194RK00644, Inv.N0294RK00044, Almaty (Kazakhstan), 1993-1994, p.1-59. (equal in value 20 000Euro) **- project leader**
10. G.Gladoun-Xanthopoulou,A.Iskakova, E.Kruglova and N.Sebryaeva. “Synthesis of Metal-Ceramic Catalysts by SHS-method for the Process of Pyrolysis, Hydrogenation and Oxidation”, Final Research Report, State Registration N 0194RK00892, Inv. N0294 RK 00050, Almaty (Kazakhstan), 1994-1995, p.1-54(equal in value 30 000Euro) **- project leader**
11. G. Gladoun-Xanthopoulou, A. Baydeldinova, T. Chernoglazova and L. Ilchenko. “Synthesis of Pigments on the Basis of Raw Wollastonites for Multiple applications and Study of Their Physicochemical Properties”, Final Research Report, State Registration N 0194RK00663, Inv. N0294RK00045, Almaty (Kazakhstan), 1994, p.1-39. (equal in value10 000Euro) **- project leader**
12. G. Gladoun-Xanthopoulou, T. Chernoglazova and L. Ilchenko. “Study of Liquation, Combustion Process in the Thin Layer on Carriers aimed at Reception Unfrited Glaze Cover with High Decorative Effect ”, Final Research Report, State Registration N 0194RK00664, Inv.N0294RK00046, Almaty (Kazakhstan), 1994, p.1-95(equal in value 5000 Euro) **- project leader**
13. G.Gladoun-Xanthopoulou, T.Chernoglazova, E.Kruglova, T.Mironova and A.Iskakova, “Study of SHS Minerals, Spinels Processes and Theory of Their Formation“, Final Research Report, State Registration N 0194RK00645, Inv. N0294RK00047, Almaty (Kazakhstan), 1994, p.1-49. (equal in value 4000 Euro) **- project leader**
14. G.Gladoun-Xanthopoulou, T.Chernoglazova and A.Baydeldinova. “Development of Manufacture Technology of Ceramic Tiles for Internal Wall Facing on the Basis of Raw Materials Resources of Ural Region and Wastes of Production“, Report, State Registration N 0194RK00666, Inv.N0294RK00048, Almaty (Kazakhstan), 1994, p.1-66. ((equal in value 5000 Euro) **- project leader**
15. G.Gladoun-Xanthopoulou and S.Gostev, “Development of Composition of Carriers and SHS Composition on the Basis of Metal Oxides of 7 and 8 Group Periodic Table: Investigations of Dependence of Critical Thickness on Properties of Carriers”, Final Research Report, State Registration N 0194RK00900, Inv.N0294RK00085, Almaty (Kazakhstan), 1994, p.1-57 published (equal in value 5000 Euro) **- project leader**
16. G. Gladoun - Xanthopoulou, A. Baydeldinova and T. Chernoglazova. “Investigation of SHS Systems on the Basis of Transition Metal Oxides with Special Electrophysical and Catalytical properties: Investigation of Regularity of Combustion of Nickel SHS Catalysts”, Final Research Report, State Registration N 0194RK00878, Inv.N0294RK00095, Almaty (Kazakhstan), 1994, p.1- 44 (equal in value 3000 Euro) **-project leader**
17. G. Xanthopoulou,A.Iskakova, T.Chernoglazova, L. Ilchenko.Development of new production technology of colored artificial stones on base of SHS technolog, Kazakhstan Programme on industrial R&D,1993-1995 (equal in value 10000 Euro) **- project leader**
18. G. Xanthopoulou, “Synthesis of Metal-Ceramic Catalysts by SHS-method for Pyrolysis, Hydrogenation and Oxidation Processes”, Kazakhstan Program on industrial R&D, 1995-1996(equal in value 6000 Euro) **- project leader**
19. G. Xanthopoulou, A.Iskakova, N. Sebryaeva “Development of Catalysts for Synthesis of Final and Intermediate Products by Pyrolysis of Methane or Natural Gas”, Kazakhstan Programme on industrial R&D, 1995-1996 (equal in value 5000 Euro) **- project leader**

### **SCIENTIFIC PROJECTS SINCE 1996 (Greece)**

### INTAS96-825 “Methane-->Acetylene-->Artificial liquid fuel”,Joint reserch collaboration between Institue Material Science, NCSR”Demokritos” (Greece), Combustion problems Institute(Kazakhstan), Fossil Fuels Institute(Russia), Free University of Brussels (Belgium), 1996-1998, p.1-98. (60000 Euro) **- project co-leader**

1. SHS catalysts for exhausted gas conversion,1999-2000 **- co-project leader**
2. Fusion Association EURATOM/Hellenic Republic,Progress report for the period 1999-2000.Joining of SiC/SiC using a controlled wave combustion method, p.49-50 (100 000 Euro)
3. Development SHS catalysts for naphtha pyrolysis, LG Chemicals Ltd, Chemical Process and catalysis Research Institute Taejon, Korea 2000-2001 (250 000Euro) **- project leader**
4. YPER, Microwave heating of ceramics, GSRT, Hellenic Republic, 2001-2003, (76000 Euro), **- project co-leader**
5. PRAXE A “Spin-off support stage A”,(for GALEXIC A.E. company) GSRT, 2002-2003 (50 000Euro), **- project leader**
6. HYDRA”, “Hybrid ablative development for re-entry in planetary atmospheric thermal protection”, FP7/Space 283797, European countries collaboration, 2007-2008 (50000 Euro)
7. G.Xanthopoulou, FY2011 JSPS Japan Society for the promotion of Science, Japan, Tokyo, 2011 (equal in value 30 000 Euro) **- project co-leader**
8. Rastas Spear, Radiation shapes Thermal protection investigation for high-speed earth re-entry, FP7 European countries collaboration, 2010-2013 (260 000 Euro)
9. “PULCHER”, Pulsed Chemical Rocket with Green High Performance Propellants”, FP7/Space 313279, European countries collaboration,2012-2015, (170 000 Euro)
10. “ReWiG” “Resistive wire grid TPS recession sensor”, ESA/ESTEC, ESA,2014-2015, (50 000 Euro)
11. “ELMHTEK”, lame-sprayed coatings for printing cylinders, GSRT project, European countries collaboration, 2013-2014 (75 000Euro)
12. IRENA, International Re-entry Demonstrator Action, EC, HORIZON 2020, 2015-2016 (862 000 Euro)
13. Application of Catalytic technologies in gas turbines engine construction, Ministry of Education and Science of the Russian Federation, collaboration with Samara State Space University named academician S.Korolev,Russia, Samara, 2014-2015 (equal in value 150 000 Euro) **- project co-leader**
14. Development of new composit materials by combustion synthesis method for methane catalytic reforming to synthesis gas and hydrocarbons. Ministry of Education and Science of Kazakhstan), collaboration with D.V. Sokolsky Institute of Fuel, Catalysis and Electro-Chemistry,Kazakhstan,Almaty, 2015-2017 (equal in value 100 000 Euro). - project co-leader
15. Program (K2-2014-012) of Russia supporting collaboration with leading scientists from abroad, collaboration with National Technological Research University of Steel and Alloys, Moscow, 2016-2017 - project co-leader
16. «Development of technologies to create a family of energy efficient and environmentally safe biofuel gas turbine drives for power plants up to 400 kWth capacity» **2016-2017,** Ministry of Education and Science of the Russian Federation, collaboration with Samara State Space University named academician S.Korolev,Russia, Samara, **- project co-leader**

**EXHIBITIONS**

1. Participation (SHS catalysts, pigments, refractories, tiles) in Scientific Applications Exhibitions of Kazakhstan in 1987,1989, 1990, 1992,1993, 1994, 1995
2. Participation (SHS catalysts, pigments) in Scientific Applications Exhibitions of USSR, [The Exhibition of Achievements of National Economy (VDNKh)](https://www.google.gr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwip-uSNkt_OAhXDvhQKHUsfD3sQFgg0MAE&url=https%3A%2F%2Fwww.tripadvisor.com%2FAttraction_Review-g298484-d524833-Reviews-The_Exhibition_of_Achievements_of_National_Economy_VDNKh-Moscow_Central_Russia.html&usg=AFQjCNGBIEFhIYCs8yzux36ZurT-8oI8mg&sig2=Ft19cgHu7NiZ1w7a5FqGyQ) 1989
3. Participation (SHS catalysts, refractories, pigments) in Scientific Applications Exhibitions in Greece, GSRT.

**RECENT SUPERVISION OF INTERNSHIP PROGRAM STUDENTS**

1. Nastaran Tamjidi from Tokyo Technological Institute 2010,
2. Ryuma M. Matsuda from Tokyo Technological Institute 2014(PhD defended in February 2016) ) “ Development, characteristic of ceramic hollow spheres and their application “
3. Vladislav Novikov from Samara State Aerospace University(SSAU), PhD title: “Development of Cu-Cr –O catalysts by solution combustion method for carbon monoxide oxidation “(2015-2018)
4. Kaumenova Gulnar Nurbolatovna, PhD student of the Chemical Department at Al-Farabi Kazakh National University in speciality “6D073900-Petrochemistry” , PhD dissertation with the title: “Development of composite materials by combustion synthesis for catalytic methane reforming into hydrocarbons and synthesis-gas”(2016-2019)
5. 7 students from Kazakh Al-Farabi National University, Almaty, Kazakhstan-visiting students for 20 days, March 2014
6. 8 students from Kazakh Al-Farabi National University, Almaty, Kazakhstan, September 2015
7. 5 students from Kazakh Al-Farabi National University, Almaty, Kazakhstan-visiting students for 14 days, July 2016

# External Collaborators:

# Professor O Odawara, Tokyo Institute of Technology, Tokyo, Japan

* Dr Jean-Marc Bouilly, Airbs D&S
* Professor L. Zouboulakis, and Professor S. Polymenis, Chemical Eng., NTUA, Greece
* Dr Alexander Sytchev ,ISMAN, Moscow, Russia
* Prof. Alexander Mukasyan, Univ. Notre Dam, USA
* Prof. Shteinberg, Institute of Applied Chemistry RAS, Moscow, Russia
* Prof. V.Prokofiev, Tomsk state University, Tomsk, Russsia
* Dr. A. Sveshnikov, “Tupolev”, Design buro, Moscow, Russia
* Dr. Yu.Hodzhaev, Central Aerodinamic Institute(TSAGI)-space shuttles construction, Zhukovskii, Russia
* Prof. E.Levashov, National University of Science and Technology «MISiS», Moscow, Russia
* Prof.S.Tungatarova, Institute of fuel, catalysis and electrochemistry named D.V Sokolskii, Almaty, Kazakhstan
* Prof.Won Ho Lee, LG Chemicals Ltd, Chemical Process and catalysis Research Institute Taejon, South Korea
* Prof. K.Martirosyan, Texas University, USA
* Dr Lucio Torre, ALTA, Italy
* Dr Jorge Barcena Pereda, Tecnalia, Spain
* Dr M. Vardavoulias, Pyrogenesis SA, Greece
* Dr A. Lekatou, University of Ioannina, Greece
* Prof.Yu.Knysh, Samara Aerospace University, Russia
* Prof. .Amosov, Samara Technical University, Russia
* Prof. Mansourov, ICP, Kazakhstan
* Prof. M.Tulepov, Al-Farabi State University, Kazakhstan
* **Dr.D.Vrel, French National Center for Scientific Research, Paris, France**
* Dr. A. Baideldinova, ICP, Kazakhstan
* Prof. Shteinberg,The University of California, Berkley

## PUBLICATIONS, PRESENTATIONS, PATENTS ETC

340 total publications and presentations: 186 international publications, 46 chapters in published books, 47 national conference presentations, 32 major industrial and research published reports, 39 patents, numerous seminars and colloquia, more than 100 plenary talks and invited lectures all over the world.

**SELECTED RECENT (from 2013) STUDENTS’ SUPERVISED DISSERTATIONS**

### S.Varitis ([Aristotle University of Thessaloniki](https://www.google.gr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjsr86Z0crOAhVHCsAKHZL7AMUQFgggMAA&url=https%3A%2F%2Fwww.auth.gr%2Fen&usg=AFQjCNF9iqSQwTGd9d0sy_8o19VnuR6p3w&sig2=Tlw2ESVmWQEdSjP2I5Si4w)),” Syngas production by combined carbon dioxide reforming and partial oxidation of methane over nickel, cobalt, manganese SHS catalysts”, Master degree defended 2013.

* I.Faroupos (NTUA)” Self- Propagating High- Temperature Synthesis of materials on the base of Lunar regolith in vacuum “, Master degree defended May 2013
* K. Arvanitis (NTUA)”Production of refractory materials by Self- Propagating High- Temperature Synthesis on the base of Lunar regolith “, Master degree defended May 2013
* N.Pagonis (NTUA)” Development of Ni-based SHS catalysts for hydrogenation processes”, defended master degree in April 2013
* O.Thoda (Coventry University, UK) “Production and characterisation of cobalt nanopigments produced by solution combustion method”, Master degree defended May 2014 , now working on PhD(2015-2017)” SHS and Solution combustion catalysts for liquid phase hydrogenation”, will be defended in Coventry University, UK
* M. Kouvertaki (NTUA) “Nanocatalysts development produced by solution combustion method for soot oxidation” Master degree, defended May 2014
* A.Marinou (University of Ioannina) “Synthesis and characterization of Ni-Al coatings produced by in-flight combustion (SHS) Assisted Flame Spraying”(2011-2014), PhD defended in February 2016.
* K.Karanasios (NTUA),” Development and characterization of catalysts produced by combustion synthesis for carbon dioxide dry reforming of methane”(2012-2014), PhD defended 20 of April 2015
* I.Pavlou (Athens School of Fine Arts),”Synthesis and characterization of luminescent nanopigments produced by Solution Combustion Method” Master degree defended in June 2015
* K.Bangos ([Aristotle University of Thessaloniki](https://www.google.gr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjsr86Z0crOAhVHCsAKHZL7AMUQFgggMAA&url=https%3A%2F%2Fwww.auth.gr%2Fen&usg=AFQjCNF9iqSQwTGd9d0sy_8o19VnuR6p3w&sig2=Tlw2ESVmWQEdSjP2I5Si4w)), “Synthesis and characterization of refractories on the base of Greek minerals and wastes by method SHS”, Master degree defended in June 2015.
* D. Tzavelas (NTUA) “ Solution combustion synthesis of nanometals”, Master degree will be defended in 2017
* M. Matsuda (Tokyo Technological Institute) PhD defended in Tokyo Tech University in February 2016
* V.Novikov. “Solution combustion synthesis of catalysts for CO oxidation”, Samara State Aerospace University named S.P. Korolev, Russia, PhD student (2015-2017)
* K.Papadopoulos (University of Ioannina) “CAFSY method application for in-flight SCS thermal coating catalysts for Co and soot oxidation, Master degree 2016-2017
* Bakirova Botagoz Sanatkyzy PhD student of the Chemical Department at Al-Farabi National University,Almaty, Kazakhstan in speciality “6D073900-Petrochemistry” and perform her PhD dissertation with the title: Catalityc transformation of olefins

**INVITED SEMINARS AND COLLOQUIA - COURSES (selection)**

1. “Catalysts for isobutylene liquid phase oxidation“, Tashkent, Uzbekistan, USSR, 1972 (invited talk)
2. Conferences"Catalytic oxidation in the liquid phase", Alma-Ata, Kazakhstan, USSR 1974,1978,1983(talks)
3. "Industrial catalysts", Baku, Azerbaidjan,USSR, 1979 (invited talk)
4. "Heterogeneous catalysts", Moscow, Russia,USSR 1980,1983,1985(invited talks)
5. “Liquid Phase Oxidation of Propylene to Acrylic Acid and Propionic Aldehyde on Palladium Catalysts”, Dzerzhinsk, Russia, USSR,1983 (invited talk)
6. "Pyrolysis of liquid fuel" Novosibirsk, Russia, USSR, 1987,1988,1989(invited talks)
7. “SHS catalysts for diesel pyrolysis”, Institute of catalysis, Novosibirsk,Russia, USSR, 1986 (invited talk)
8. "New methods of preparation of catalysts" Perm, Russia,USSR, 1987(invited talk)
9. "Problems of methane in Industry", Ministry of Chemical Industry, Moscow, 1988 (invited talk)
10. Magnesium spinel refractories”, Podolsk refractory plant, Russia,USSR, 1988 (invited talk)
11. SHS pigments for ceramic tiles” Moscow ceramic plant, 1987, Russia, invited talk.
12. ”Development of high-temperature ceramic structure for the forward edge of flying apparatus”, [Tupolev](http://en.wikipedia.org/wiki/Tupolev) construction bureau,Moscow,USSR1988,1989(invited talks)
13. Development of high-temperature Isolation screen for temperatures 1900-2000oC ”Opyt" plant (space agency) , Zhukovsky, Moscow, USSR,1989(invited talks)
14. "SHS Catalysts" ISMAN, Moscow, Russia,USSR 1989(invited talk)
15. "SHS in Industry", SHS International conference,Almaty,Kazakhstan,1990 (plenary talk)
16. "Catalysis", Institute of Chemical Physics, Moscow, Russia,1990(invited talk
17. .Seminar of Institute of Catalysis and Electrochemistry, Alma-Ata,Kazakhstan,1990(invited talk)
18. Seminar of Institute Structural Microkinetics, Moscow,1990(invited talk)
19. SHS catalysts, Institute of Chemical Physics,Moscow, Russia,1990(invited talk)
20. SHS catalysts, Institute of Organic Chemistry,Moscow, Russia,1990(invited talk)
21. Course of Seminars of Chemical Department of Kazakh University "Catalysis and Technical chemistry", "Combustion processes", Alma-Ata 1976-1994, 12-15 hours/year (full professor position)
22. Seminars of combustion Problems Institute (ICP), Alma-Ata,1988-1995, 5-7 seminars/year
23. Course of 6 seminars of NTUA, Metallurgy Section, Athens,1994,1996,1999 invited talks
24. SHS pigments, Company”Filkeram Jonson”, Thessaloniki, Greece, 1996 invited talk
25. SHS Pigments, company “Argo”, Athens,Greece,1996, invited talk
26. “Self-Propagating High-Temperature Synthesis of Catalysts and Carriers”, Institute of Materials Science, NCSR "Demokritos" 1997.
27. “Synthesis of SiC by method SHS”, Institute of Nuclear reserch, Lisbon, Portugal,December 1999,Invited lecture.

### Visiting professor.Course of Seminars of LG Chemicals. Daejeon,Korea, invited talks, July 2001

1. Seminar of University , Poitiers, France,invited talk, 2002
2. Course of Seminars “SHS catalysts for different aplycation” SABIC Technology Center ,Sugar Land, TX, USA, 2003 , invited lectures
3. Visiting professor.«SHS method», «SHS catalysts» McGill, Chemical department, Montreal, Canada ,2003, invited talks.
4. G.Xanthopoulou, "Review of SHS for Catalytic Application", 9th International Symposium on SHS, Dijon, France, 1-5July 2007, p.27-28.(plenary invited talk)
5. G.Xanthopoulou, George Vekinis and G.I.Ksandopulo “Kazakhstan-Greece Cooperation in the field of SHS”, International Conference on Historical Aspects of SHS in Different Countries, Moscow,Russia, 22-27 October 2007, p.13 (plenary, invited talk)
6. Visiting professor."Areas of potential collaboration between NCSR "Demokritos“,Tokyo Tech and ICP and sources for funding"2010 Almaty(invited seminars talks)
7. TPS on the base of Mg-Al-O SHS material", JUSTSAP FORUM, Kohala Coast, Island of Hawaii November, 2009, invited talk
8. G.G.Xanthopoulou, G.A. Vekinis, “Hybrid thermal protection system for spacecraft based on MgO SHS refractories” 10th International Symposium on SHS, Tsakhkadzor, Armenia, 6-11July 2009, p.152-153.(invited plenary talk)
9. Catalytic Properties of the SHS products.
Review, 2010, Montecatini Terme, Italy, June, 2010(plenary talk).
10. Visiting professor.Prospective of Collaboration between Tokyo Institute of Technology and National center for Scientific Research ”DEMOKRITOS” 2010 Tokyo (invited seminars talks)
11. G.G.Xanthopoulou, “Review of Development of SHS catalysts”, 5th International Symposium “Combustion and Plasmochemistry”, Almaty, Kazakhstan, 16-18 September 2009 (plenary talk)
12. Department of Mechanical Engineering, San Diego State University,San Diego, CA,” "Overview of some advanced applications of SHS",8 of Auguest,2011(invited talk)
13. Visiting professor.Invited lectures in Tokyo Institute of Technology (16 hours),2010
14. Chair person of XI SHS symposium 5-9 September 2011. . <http://web.ims.demokritos.gr/SHS2011>, 2 plenary talks, member of international organizing committee of SHS 1991, SHS2009,SHS2011,SHS2013, SHS2015
15. Periods during 1995-1996: Visiting professor Section of Metallurgy, Department of Mining Engineering and Metallurgy, National Technical University, Athens, Greece.
16. Visiting professor Visiting professor. Japan Society for promotion of Science(JSPS) invited to Japan under program “FY2011 JSPS Invited Fellowship Program for Research in Japan” for reading lectures in different Universities and Institutes of Japan (Sapporo, Tokyo, Kyoto) during 33 days(19 September-23 of October 2011).
17. Visiting professor November 2012 Al-Farabi Kazakh National University,Almaty, Kazakhstan,36 hours of lectures.
18. Plenary talk .G.Xanthopoulou, COMBUSTION SYNTHESIS OF MATERIALS ADDRESSES CURRENT AND FUTURE INDUSTRIAL CHALLENGES, 11th SHS International Symposium on SHS, 5-9 of September 2011, Anavissos, Greece
19. Invited talk “Solution Combustion Synthesis of nanoparticle materials in a scalable process that can be useful for solar fuels production from CO2 + H2O + sunlight --> CH4 or CH3OH “ University of Toronto, Chemical faculty, Toronto,Canada, 8May 2013
20. G. Xanthopoulou ,”SHS for in-situ resource utilization on the Moon and Mars”, SHS2013, 21-24of October, South Padre Island,TX,USA (invited key-note lecture)
21. G. Xanthopoulou “Combustion Synthesis, a new class of Combustion processes for Materials Production. “ Review(invited lecture).South California University,6 November 2013
22. Visiting professor G. Xanthopoulou 27 Jan -1 Feb 2014 Tokyo Technological Institute
23. Visiting professor , Kazakh Al-Farabi National University, September 2014,80 hours lectures
24. Plenary talk, International symposium for plasma-chemistry,17-19September 2014, Almaty, Kazakhstan
25. G.Xanthopoulou,“Solution Combustion Synthesis of Nanomaterials”) 6 Greek symposium of Ceramics, Athens, 3-4 April 2014, p.33-34.(invited talk)
26. G. Xanthopoulou, Nanocatalysts produced by combustion synthesis for CO2 dry reforming of methane, VIII International Symposium Physics and Chemistry of carbon Materials/ Nanoengineering, 17-19 September, Almaty, Kazakhstan(plenary invited talk), 2014
27. G.Xanthopoulou, visiting professor, Samara State Aerospace University(SSAU), Russia, 11November-12 December 2014, 11 January-12 February 2014, 11 March-12 April, visiting professor, reading lectures 25 lectures, consulting” Increasing effectiveness of gas turbines motors”. Invited professor, responsible for scientific development of Laboratory of Catalytic Processes in Gas Turbines Construction, Samara State Aerospace University named S.P. Korolev
28. G.Xanthopoulou, visiting professor, The D.V.Sokolsky Institute of Organic Catalysis and Electrochemistry, Republic of Kazakhstan, Almaty, consulting “New composite materials synthesis by combustion process for catalytic reforming of methane to hydrocarbons and synthesis gas” 2014- 2016.
29. G.Xanthopoulou, visiting professor, ICP, Almaty, “SCS”, December 2016.
30. G.Xanthopoulou, visiting professor, MISIS, Moscow, June 2017.
31. G.Xanthopoulou, visiting professor, Samara Space University, September 2017

**Prof. Galina Xanthopoulou**

**PhD, DSc** (= higher than PhD scientific degree, equivalent to habilitation)

For 20 years until 1996

I was not permitted to publish articles in international Journals because of working with secret documents and projects. During this period main results were published as chapters in books with specific classification, reports(with USSR registration numbers) and patents.

#### LIST OF PUBLICATIONS AND PRESENTATIONS

**PUBLICATIONS (Refereed Articles, Monographs)**

1. V.Druze, Z.Novicova, G.Gladoun-Xanthopoulou and S.Aselcan, “Influence of Acetic Acid on the Oxygen Absorption on Palladium”, J.Physical Chemistry,1982,v.56, N4,p.1039-1040.
2. V.Druze and G.Gladoun-Xanthopoulou, “On the Method of Preparation of Frampton`s Catalysts”, J.of Applied Chemistry, 1983, N 10, p.2369-2371.
3. G.Gladoun-Xanthopoulou, “Liquid Phase Oxidation of C3-C4 Olefins on Palladium Catalysts”, Author`s Abstract of PhD Dissertation, Alma-Ata(USSR), 1983, p.1-23.(published in 300 copies and sent to all central libraries of USSR)
4. G.Gladoun-Xanthopoulou, “Liquid Phase Oxidation of C3-C4 Olefins on Palladium Catalysts”, PhD Dissertation, Alma-Ata (USSR),1983,p.1-170.
5. G.Gladoun-Xanthopoulou, V.D. Gladoun and L. Astapenkova, “Investigation of chromate concentrates as resources for high temperature synthesis of catalysts”, J. of Complex Utilisation of Mineral Resources, Alma-Ata, 1990, N 10, p. 49-53.
6. G.Gladoun-Xathopoulou, Monograph “Self-propagating High-temperature Synthesis of catalysts and supports”, Alma-Ata(USSR), 1990, p.1-61, Nauka.
7. G.Gladoun-Xanthopoulou. “Self-propagating High-temperature Synthesis of Catalysts and Supports”, Author`s Abstract, Doctor of Science Disertation, 1991, p.1-45.( printed in 500 copies and sent to all central libraries of USSR)
8. G. Gladoun-Xanthopoulou and E. Baymouhamedov. “SHS High- Temperature Light-Weight Refractories”, Engineering-Physics Journal, v.65, N4, 1993, p.490-491.
9. G. Gladoun-Xanthopoulou. “Self-propagation High-temperature Synthesis of Catalysts and Supports”, Intern. J. of Self-propagation High-temperature Synthesis, V. 3, N1, 1994, p. 51-58.
10. G.Gladoun-Xanthopoulou, E.Baymouhamedov and A.Sherinhanov, “SHS High-temperature Light Refractories”, J. Eng. Phys. Thermophys., v.65, N4, 1993, p.1024-1025( USA).
11. G.Gladoun-Xanthopoulou, T.Chernoglazova and G.Ksandopulo. ”Interaction of SHS-pigments with Glazes in Films on the Carrier", International J. of Self-propagation High-temperature Synthesis, V. 6, N1, 1997, p.71-76
12. G.Gladoun-Xanthopoulou, “SHS of Catalysts, Carriers, Pigments and Refractories. I. Synthesis of Catalysts and Carriers based on pure materials”, Journal of Mining and Metallurgical Annals, 1997, p.51-66 [in Greek].
13. G.Gladoun-Xanthopoulou.” SHS of Catalysts, Carriers, Pigments and Refractories. II. Synthesis of Catalysts and Carriers based on Ores, Concentrates, Slags and Ashes.” Journal Mining and Metallurgical Annals, 1997, p. 67-76 [in Greek].
14. G.Gladoun-Xanthopoulou, “SHS of Catalysts, Carriers, Pigments and Refractories. III. Synthesis of Pigments” Journal Mining and Metallurgical Annals, 1997, p.77-88 [in Greek].
15. G.Gladoun-Xanthopoulou,V.Sergienko and G.Ksandopulo.”The combustion wave structure of SHS-systems based on the Compounds of Iron and Manganese oxides” Int. J. of Self-propagating High-Temperature Synthesis, V. 6, N4, 1997, p.399-404
16. G Xanthopoulou and G.Vekinis "Investigation of Catalytic Oxidation of CO over a Cu-Cr-oxide Catalyst made by Self-Propagating High-Temperature Synthesis". Applied Catalysis B: Environmental, 19(1998), p.37-44.
17. G. Xanthopoulou, "SHS pigments", Amer. Cer. Soc Bulletin, 77,1998, p.87-96.
18. G Xanthopoulou, “Oxide catalysts for pyrolysis of diesel fuel made by self-propagating high-temperature synthesis. Part I:cobalt-modified Mg--Al spinel catalysts “Applied Catalysis”, A:General, 182, 2,1999, pp.: 285-295.
19. G Xanthopoulou, Oxide catalysts for pyrolysis of diesel fuel made by self-propagating high-temperature synthesis (SHS): Part II: Fe-Cr oxide catalysts based on chromite concentrates Applied Catalysis A: General 1999, 187:1:79-88
20. G Xanthopoulou, “Oxidative dehydrodimerization of methane using manganese based catalysts made by self-propargating high-temperature combustion synthesis” , Chemical Engineering and Technology, 24(2001)10, 1025-1034.
21. G Xanthopoulou, “Oxidative dehydrodimerization of methane using lead and samarium based catalysts made by self-propargating high-temperature synthesis, Applied Catalysis”, A: General, 185, 1999, L185-L192 .
22. G. Xanthopoulou and G.Vekinis, “Influence of cooling conditions on the composition, microstructure and activity of SHS catalysts”, International Journal of Self-Propagating High Temperature Synthesis, 3,v.8,1999, p.287-298.
23. G Xanthopoulou and G Vekinis, An overview of some environmental applications of the self-propagating high temperature synthesis”, Advances in Environmental reserch ,v.5: 2, 2001, p.117-128.
24. G. Xanthopoulou, G.Vekinis“Deep oxidation of methane using catalysts and carriers produced by self-propagating high- temperature synthesis”, Applied Catalysis A: General 2000, 199:2:227-238.
25. Xanthopoulou and G.Vekinis, “MgO/MgAl2O4 refractories by SHS”, Internation Journal of Self-Propagating High Temperature Synthesis,1,v.11,2002.
26. George Vekinis and G.Xanthopoulou,” A new concept for a hybrid TPS for multiple atmospheric entry probes:a porous ceramic refractory containing an ablative polymer composite or other phase-transition material”, Proceedings of 3rd International Planetary Probe Workshop, Anavyssos, Attiki, Greece, June 27- July 1, 2005, Editor:ESA, WPP-263 2006.
27. G.Xanthopoulou and George Vekinis,” SHS Catalysts:Synthesis, Properties and Applications”, Advances in Science and Technology, Trans Tech Publications Ltd, Zurich, v.45, p.1058-1066, 2006.
28. N. Mofa, Z. Mansurov, G. Xanthopoulou, “ Composite materials on the basis of silica- modified systems with high sorption activity for water surface cleaning”, Euro-Asian Journal of Sustainable Energy Development Policy, Volume 2, Issue 1, 2010 **,** p.39-47,p.105-114.
29. G.Ksandopulo,A.Baydeldinova, S.Kartkuzhakov, O.Bairakova, N.Gassan, G.Xanthopoulou,  “Prevention of radioactive and some other contaminants leaching into soil by high temperature fixing”, Euro-Asian Journal of Sustainable Energy Development Policy, Volume 2, Issue 1, 2010, p.59-69,125-130.
30. G Xanthopoulou, “Enhanced combustion of soot in diesel exhaust gases with the use of catalysts made by SHS”, to be submitted to Applied Catalysis B: Environmental, 2008
31. G.G.Xanthopoulou, G.A. Vekinis,”Catalytic pyrolysis of naphtha on the SHS catalysts”, Eurasian Chemico-Technological Journal , v.12,n.1,2010,p. 17-21
32. G.Xanthopoulou, Self-Propagating High-Temperature Synthesis as method of catalysts production, Science of Central Asia, (review and interview), n.4, 2010, pp.35-55
33. G. Vekinis and G. Xanthopoulou “HybridTPS: A Novel Thermal Protection System for Atmospheric Entry Space Probes Based on SHS- Produced MgO-spinel refractories Internation Journal of Self-Propagating High Temperature Synthesis, no.4, v.19,2010,p.258-275.
34. G.Xanthopoulou,Catalytic Properties of the SHS products, Advances in Science and Technology Vol. 63 (2010) pp 287-296.
35. G.Xanthopoulou , Some Advanced Applications of SHS: An Overview, Internation Journal of Self-Propagating High Temperature Synthesis, no.4, v.20, 2011,pp 269-272.
36. G.Xanthopoulou, Preface, SHS2011, Eurasian Chemico-Technological Journal, v.13,n.3-4,2011,p.112-113
37. G.Xanthopoulou, Development of new processes for in-situ resource utilization (ISRU) on Moon and Mars, Applied Space, N1,2013,p.24-40.
38. G. Xanthopoulou, A. Marinou, G. Vekinis, A. Lekatouand M. Vardavoulias “NiAl and NiO-Al Composite Coatings by Combustion-Assisted Flame Spraying”, Coatings 2014, 4,231-252. doi: 10.3390/coatings 4020231, ISSN 2079-6412, [http://www.mdpi.com/2079-6412/4/2/231 (Impact](http://www.mdpi.com/2079-6412/4/2/231%20%20%28Impact) factor 2.35)
39. G. Xanthopoulou ,S. Varitis, K. Karanasios, G. Vekinis” SHS-Produced Ni-Co-Al-Mg-O Catalysts for Dry Reforming of Methane” , SHS Journal ,vol.23,no.2, 2014, pp.92-100, ISSN 1061-3862
40. K.Karanasios, G. Xanthopoulou, G. Vekinis, L. Zoumpoulakis,”Co-Al-O catalysts produced by SHS method for CO2 reforming of CH4”, SHS Journal,Vol. 23, No. 4, 2014,p.221-229.
41. A.Marinou, G. Xanthopoulou, G.Vekinis, A. Lekatou, M. Vardavoulias,Synthesis and Heat Treatment of Sprayed High-Temperature NiAl-Ni3Al Coatings by In- Flight combustion Synthesis (CAFSY), Int. Journal of SHS, 2015, Vol. 24, No. 4, pp. 192–201
42. G.Xanthopoulou, V.Novikov, Yu.Knysh, A. Amosov, Nanocatalysts for Low-temperature oxidation of CO. Review, Eurasian Chemico-Technological Journal, 17,no.1, 2015, p.17-32.
43. G.Xanthopoulou, Yu.Knysh, A. Amosov,SHS Catalysts and Improving of Natural Gas Combustion Quality in Heat Engines by Additives of Synthesis Gas: A Review, Int. J. SHS, 2015, vol. 24, no. 2,p.56-62.
44. S.A. Tungatarova, G. Xanthopoulou, T.S. Baizhumanova, K.Kassymkan, M. Zhumabek, Nanosized Pt-Ru catalyst in Selective Oxidation of Methane into synthesis gas, 22nd International Sympositum on Metastable Amorphous and Nanostructured Materials, ISMANAM 2015, Paris, France, July 13th-17th , 2015,p. 360.
45. G. Xanthopoulou, Space technologies at the service of mankind, Applied space, no 3-4, 2016, p.28-59
46. A. Panagopoulou, K. Karanasios, G.Xanthopoulou, Ancient Egyptian Blue (CaCuSi4O10) Pigment by Modern Solution Combustion Synthesis Method ,Euro-Asian Technological Journal, v.18(1)2016, p. 31-37
47. G. Xanthopoulou, O. Thoda, E. D., Metaxa, G. Vekinis, A. Chroneos,Influence of atomic structure on the activity of nano-structured nickel-based SCS catalysts during hydrogenation of maleic acid , Journal of Catalysis,v.348, 2017, p.9-21 http://www.sciencedirect.com/science/article/pii/S0021951716303074
48. G.Xanthopoulou, A. Marinou, K. Karanasios, G. Vekinis, In-flight SHS  during thermal spraying (CAFSY) as new coating method for catalysts on carriers production, Invited article for Special Issue "Five Years of Coatings: Coatings Science and Technology for the 21st Century", Coatings, 7, 14, 2017 doi:10.3390/coatings7010014 **(**Impact factor 2.35)
49. G.Xanthopoulou, K.Karanasios, S.Tungatarova, T.Baizhumanova, Z.Zheksenbaeva, , G.Vekinis, Development of composite materials by combustion synthesis for catalytic methane reforming into hydrocarbons and synthesis-gas, Chemical Engineering and Technology,2017(accepted)
50. S. Tungatarova, G. Xanthopoulou, T. Baizhumanova, Z. Zheksenbaeva, Z. Manapkhan, K. Kaisar, Production of synthesis gas from methane on Ni- containing nanosized Catalysts , Organic Process Research & Development, ACS Publications, vol. 21, n. 2017, p.. Impact factor 2.922
51. Yu. Knysh and G. Xanthopoulou, New metamaterials with combined subnano - and mesoscale topology for high-efficiency catalytic combustion chambers of innovative gas turbine engines Journal of Physics: Conference Series, Samara 28-30 of October 2017 , Materials of [2017 International Conference on Aerospace Technology, Communications and Energy Systems (ATCES 2017)](http://www.apise.org/cp/html/?49.html) (Impact factor 3.13)
52. V. Novikov, G. Xanthopoulou, Yu.Knysh, A.P. Amosov “Solution Combustion Synthesis of nanoscale Cu-Cr-O spinels: mechanism, properties and catalytic activity in CO oxidation, Ceramics International, http://dx.doi.org/10.1016/j.ceramint.2017.06.004, Impact factor 2.88, Q1
53. Svetlana A. Tungatarova, Galina Xanthopoulou, Konstantinos Karanasios,Tolkyn S. Baizhumanova, Manapkhan Zhumabek, Gulnar Kaumenovac, New Composite Materials Prepared by Solution Combustion Synthesis for Catalytic Reforming of Methane, CHEMICAL ENGINEERING TRANSACTIONS, VOL. 61, 2017,p.1921-1926, ISBN 978-88-95608-51-8; ISSN 2283-9216, <http://www.aidic.it/cet/17/61/318.pdf>
54. O. Thoda, G. Xanthopoulou, G. Vekinis, A. Chroneos, Parametric optimisation of Solution Combustion Synthesis catalysts and their application for the aqueous hydrogenation of maleic acid, Catalysis Letters, published 22 of December 2017 online, Impact factor 2.8, sent 12.10. 2017, DOI 10.1007/s10562-017-2279-y. Catalysis Letters (2018) 148:764–778(Impact factor 2.799)
55. O. Thoda, G. Xanthopoulou, G. Vekinis, A. Chroneos, Review of recent studies on Solution Combustion Synthesis of nanostructured catalysts **,** Advanced Engineering Materials, published online 10 June 2018<https://doi.org/10.1002/adem.201800047>,DOI: 10.1002/adem.201800047 (Impact factor 2.319)
56. G. Xanthopoulou , O. Thoda, S. Roslyakov, A. Steinman, D. Kovalev, E. Levashov, G. Vekinis , A. Sytschev, A. Chroneos, Solution Combustion Synthesis of nano-catalysts with a hierarchical structure, Journal of Catalysis, v.464,p.112-124, <https://doi.org/10.1016/j.jcat.2018.04.003>, Impact factor of Journal of Catalysis 7.482, Q1
57. O. Thoda, G. Xanthopoulou, V. Prokof’ev, S. Roslyakov, G. Vekinis, and A. Chroneos,Influence of Preheating Temperature on Solution CombustionSynthesis of Ni–NiO Nanocomposites: Mathematical Model and Experiment, International Journal of Self-Propagating High-Temperature Synthesis, 2018, Vol. 27, No. 4, pp. 207–215.
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6. "Pyrolysis of liquid fuel" Novosibirsk, Russia, USSR, 1987,1988,1989**(invited talks)**
7. “SHS catalysts for diesel pyrolysis”, Institute of catalysis, Novosibirsk,Russia, USSR, 1986**(invited talk)**
8. "New methods of preparation of catalysts" Perm, Russia,USSR, 1987**(invited talk)**
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10. Magnesium spinel refractories”, **Podolsk refractory plant, Russia**,USSR, 1988**(invited talk)**
11. **SHS pigments for ceramic tiles” Moscow ceramic plant, 1987, Russia, invited talk.**
12. ”Development of high-temperature ceramic structure for the forward edge of flying apparatus”, [**Tupolev**](http://en.wikipedia.org/wiki/Tupolev) **construction bureau**,Moscow,USSR1988,1989**(invited talks)**
13. Development of high-temperature Isolation screen for temperatures 1900-2000oC ”Opyt" plant (**space agency**) , Zhukovsky, **Moscow**, USSR,1989**(invited talks)**
14. "SHS Catalysts" ISMAN, Moscow, **Russia**,USSR 1989**(invited talk)**
15. "SHS in Industry", SHS International conference,Almaty,Kazakhstan,1990 (**plenary talk)**
16. "Catalysis", Institute of Chemical Physics, Moscow, Russia,1990**(invited talk**
17. .Seminar of Institute of Catalysis and Electrochemistry, Alma-Ata,Kazakhstan,1990**(invited talk**
18. Seminar of Institute Structural Microkinetics, Moscow,1990**(invited talk)**
19. SHS catalysts, Institute of Chemical Physics,Moscow, Russia,1990
20. SHS catalysts, Institute of Organic Chemistry,Moscow, Russia,1990**(invited talk**)
21. Course of Seminars of Chemical Department of **Kazakh University** "Catalysis and Technical chemistry", "Combustion processes", Alma-Ata 1976-1994, 12-15 hours/year (**full professor position)**
22. Seminars of combustion Problems Institute (ICP), Alma-Ata,1988-1995, 5-7 seminars/year
23. Course of 6 seminars of NTUA, Metallurgy Section, **Athens**,1994,1996,1999 **invited talks**
24. SHS pigments, Company”Filkeram Jonson”, Thessaloniki, Greece, 1996 **invited talk**
25. SHS Pigments, **company “Argo”, Athens**,Greece,1996, **invited talk**
26. “Self-Propagating High-Temperature Synthesis of Catalysts and Carriers”, Institute of Materials Science, NCSR "Demokritos" 1997.
27. “Synthesis of SiC by method SHS”, Institute of Nuclear reserch, **Lisbon, Portugal**,December 1999,**Invited lecture**.
28. Visiting professor.Course of Seminars of LG Chemicals. Daejeon,Korea, invited talks, July 2001
29. Seminar of University , Poitiers, France,**invited talk**, 2002
30. Course of Seminars“SHS catalysts for different aplycation” SABIC Technology Center ,Sugar Land, TX, USA, 2003 , **invited lectures**
31. **Visiting professor**.«SHS method», «SHS catalysts» McGill, Chemical department, **Montreal, Canada** ,2003, **invited talks**.
32. G.Xanthopoulou, "Review of SHS for Catalytic Application", 9th International Symposium on SHS, Dijon, **Franc**e, 1-5July 2007, p.27-28.(**plenary invited talk**)
33. G.Xanthopoulou, George Vekinis and G.I.Ksandopulo “Kazakhstan-Greece Cooperation in the field of SHS”, International Conference on Historical Aspects of SHS in Different Countries, Moscow,**Russia**, 22-27 October 2007, p.13 (**plenary, invited talk)**
34. **Visiting professor**."Areas of potential collaboration between NCSR "Demokritos“,Tokyo Tech and ICP and sources for funding"2010 **Almaty**(invited seminars talks)
35. TPS on the base of Mg-Al-O SHS material", JUSTSAP FORUM, Kohala Coast, Island of **Hawaii, 7-12** November, 2009, **invited talk**
36. G.G.Xanthopoulou, G.A. Vekinis, “Hybrid thermal protection system for spacecraft based on MgO SHS refractories” 10th International Symposium on SHS, Tsakhkadzor, **Armenia**, 6-11July 2009, p.152-153.(**invited plenary talk**)
37. Catalytic Properties of the SHS products.
Review, CIMTEC2010, 12th International Ceramic congress Montecatini Terme, **Italy,6-11** June, 2010(**plenary talk**).
38. **Visiting professor**.Prospective of Collaboration between Tokyo Institute of Technology and National center for Scientific Research ”DEMOKRITOS” 2010 **Tokyo** (invited seminars talks)
39. G.G.Xanthopoulou, “Review of Development of SHS catalysts”, 5th International Symposium “Combustion and Plasmochemistry”, Almaty, **Kazakhstan**, 16-18 September 2009 (**plenary talk)**
40. Department of Mechanical Engineering,San Diego State University,**San Diego, CA**,” "Overview of some advanced applications of SHS",8 of Auguest,2011(**invited talk**)
41. **Visiting professor**.Invited lectures in Tokyo Institute of Technology (16 hours),2010
42. **Visiting professor**. Japan Society for promotion of Science(JSPS) invited to Japan under program “FY2011 **JSPS Invited Fellowship Program for Research in Japan**” for reading lectures in different Universities and Institutes of Japan (Sapporo, Tokyo, Kyoto) during 33 days(19 September-23 of October 2011).
43. Chair person of XI SHS symposium 5-9 September 2011. . <http://web.ims.demokritos.gr/SHS2011>, **2 plenary talks**, Member of international advisory board **of SHS 1991, SHS2009,SHS2011,SHS2013, SHS2015**
44. Periods during 1995-1996: **Visiting professor** Section of Metallurgy, Department of Mining Engineering and Metallurgy, National Technical University, Athens, Greece.
45. **Visiting professor** Visiting professor. Japan Society for promotion of Science(JSPS) invited to Japan under program “FY2011 JSPS **Invited Fellowship Program for Research in Japan**” for reading lectures in different Universities and Institutes of **Japan (Sapporo, Tokyo, Kyoto**) during 33 days(19 September-23 of October 2011).
46. **Visiting professor** November 2012 Al-Farabi Kazakh National University,Almaty, **Kazakhstan**,36 hours of lectures.
47. **Plenary talk** .G.Xanthopoulou, COMBUSTION SYNTHESIS OF MATERIALS ADDRESSES CURRENT AND FUTURE INDUSTRIAL CHALLENGES, 11th SHS International Symposium on SHS, 5-9 of September 2011, Anavissos, Greece
48. **Invited talk** “Solution Combustion Synthesis of nanoparticle materials in a scalable process that can be useful for solar fuels production from CO2 + H2O + sunlight --> CH4 or CH3OH “ University of Toronto, Chemical faculty, Toronto,**Canada**, 8May 2013
49. G. Xanthopoulou **,”**SHS for in-situ resource utilization on the Moon and Mars”, SHS2013, 21-24of October, **South Padre Island,TX,US**A (**invited key-note lecture**)
50. G. Xanthopoulou “Combustion Synthesis, a new class of Combustion processes for Materials Production. “ Review(**invited lecture**).**South California University**,6 November 2013
51. **Visiting professor** G. Xanthopoulou 27 Jan -1 Feb 2014 **Tokyo** Technological Institute
52. **Visiting professor** , Kazakh Al-Farabi National University, September 2014,80 hours lectures
53. Plenary talk, International symposium for plasma-chemistry,17-19September 2014, **Almaty, Kazakhstan**
54. G.Xanthopoulou,“Solution Combustion Synthesis of Nanomaterials”) 6 Greek symposium of Ceramics, Athens, 3-4 April 2014, p.33-34.(invited talk)
55. G. Xanthopoulou, Nanocatalysts produced by combustion synthesis for CO2 dry reforming of methane, VIII International Symposium Physics and Chemistry of carbon Materials/ Nanoengineering, 17-19 September, Almaty, **Kazakhstan (plenary invited talk**), 2014
56. 55.G.Xanthopoulou, **visiting professor**, **Samara State Aerospace University(SSAU), Russia**, 11November-12 december 2014, 11 January-12 February 2014, 11 March-12 April 2015, visiting professor, reading lectures 24 lectures, consulting” Increasing effectiveness of gas turbines motors”.
57. 56.G. Xanthopoulou, Y.Knysh, A.Amosov, D,Dmitriev “Synthesis gas generation on SHS and SCS catalysts for fuel economy and purifying exhausted gases of internal combustion and gas engines” key-note lecture, SHS2015, 12-15october 2015, Antalya, Turkey
58. G.Xanthopoulou, **visiting professor**, The D.V.Sokolsky Institute of Organic Catalysis and Electrochemistry, Republic of Kazakhstan, Almaty,2014, 2015, consulting “New composite materials synthesis by combustion process for catalytic reforming of methane to hydrocarbons and synthesis gas”
59. G. Xanthopoulou, Al Farabi Kazakh State University, Almaty, Kazakhstan, August 2014
60. G. Xanthopoulou,**visiting professor**, Tokyo Institute of Technology, Japan, March 2014
61. G.Xanthopoulou, SHS2015, key note invited lecture “ Synthesis Gas generation on SHS and SCS catalysts for fuel economy and purifying exhausted gases of international combustion and gas turbine engines, XIII International symposium, October 12-15, 2015, Antalia, Turkey.
62. G.Xanthopoulou, SHS2015, key-note invited lecture “Development of solution combustion synthesis technology for nickel based hydrogenation catalysts”, XIV International symposium, September 25-28, 2017, Tbilisi, Georgia.