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 **SHS 2017**

**XIV INTERNATIONAL SYMPOSIUM ON  
SELF-PROPAGATING HIGH TEMPERATURE SYNTHESIS**

**PROGRAM**

**SEPTEMBER 25-28, 2017  
TBILISI, GEORGIA**

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**GEORGIAN NATIONAL ACADEMY OF SCIENCES**



**LEPL - FERDINAND TAVADZE METALLURGY AND  
MATERIALS SCIENCE INSTITUTE**



**MERZHANOV INSTITUTE OF STRUCTURAL MACROKINETICS  
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# PROGRAM

**Georgian National Academy Of Sciences  
Shota Rustaveli Ave. 52, Tbilisi, Georgia**

**Monday, September 25, 2017**

**09:00-10:00 Registration** (Floor 5)

**10:00-10:30 Opening ceremony**

**PLENARY SESSION - Chairman Giorgi Tavadze**

**10:30-11:15** Prof. Giorgi Tavadze (Georgia)

Successes and ways of development of SHS in Georgia

**11:15-12:00** Prof. Mikhail Alymov (Russia)

ISMAN: Present state and perspectives

**12:00-12:15 Coffee-break**

**12:15-13:15** Prof. Alexander Mukasyan (USA)

Fifty years of discovery: history and future

**13:15-14:15 Lunch**

**SECTION 1, FLOOR 5 - Chairman A.Rogachev**

**14:15-14:45** A.S.Rogachev

Self-propagating thermal waves in thin films: new kinds of SHS processes

**14:45-15:00** F. Baras, V. Turlo, O. Politano,

SHS in NiAl nanofolds: an atomistic-scale description

**15:00-15:15** T.Namicheishvili, L. Antashvili, G. Oniashvili, G.

Tavadze, Z.Melashvili, A. Tutberidze, G.Zakharov, Z. Aslamazashvili

Modeling of thermal field during SHS-electric rolling

**15:15-15:30** M.Bugdayci, K.C. Tasyurek, O.Yucel

Thermodynamic modelling of magnesium, strontium and calcium via vacuum metallothermic processes

**15:30-15:45** S. Aydinyan, S. Kharatyan

The mechanism of  $WO_3(MoO_3)$  & CuO coreduction by combined Mg/C reducer at non isothermal conditions

**15:45-16:00** C.E. Shuck, A.S. Mukasyan

Quantitative 3-D reconstruction of reactive nanocomposites: effect of nanostructure on activation energy

**16:00-16:15** V.G. Prokof'ev, V.K. Smolyakov

Capillary melt flow and spin regimes of glassless systems

**16:15-16:30** V.V. Grachev

Quasi-steady modes of filtration combustion with heat losses

## **SECTION 2, FLOOR 3 - Chairman A.Berner**

**14:15-14:45** A. Berner, G. Oniashvili, G. Tavadze, Z.Asizamashvili, G.Zakharov

Comprehensive chemical and structural characterization of composite materials produced by SHS with the help of modern microscopy techniques

**14:45-15:00** M. Kurcz, A. Huczko

Combustion synthesis of graphene-related composite nanomaterials

**15:00-15:15** J.M. Pauls, A.S. Mukasyan

Metathetical reaction mechanisms in the Ti-B-N system

**15:15-15:30** R. Rosa, L. Trombi, P. Veronesi, C. Leonelli

A comprehensive overview of the recent advancements and the most promising perspectives of microwave energy applications to combustion synthesis

**15:30-15:45** M. Kalina, G. Oniashvili, G. Tavadze, Z.Aslamazashvili,  
G.Zakharov

Studying hardness with sub-micron lateral resolution of composite materials produced by SHS with the help of picoindenter built in a high resolution scanning electron microscope

**15:45-16:00** S.K. Dolukhanyan, G.N. Muradyan, A.G. Aleksanyan,  
O.P.Ter-Galstyan, N.L.Mnatsakanyan and A.G.Hakobyan

Regularities and mechanism of formation of aluminides in TiH<sub>2</sub>-ZrH<sub>2</sub>-AL system

**16:00-16:15** A.A. Nepapushev, K.G. Kirakosyan, D.O. Moskovskikh,  
S.L. Kharatyan, A.S. Rogachev, and A.S. Mukasyan

High temperature kinetics in mechanically activated systems: electro-thermal analysis and high speed temperature scanning

**16:15-16:30** D.Yu. Kovalev, V.I. Ponomarev

Time resolved x-ray diffraction for diagnostics of SHS

**16:30-16:45** Coffee-break

**16:45-18:00** Round-table - 50 Years of SHS

Moderators: A. Mukasyan, A. Rogachev

**18:00-18:30** Advisory Committee Meeting

**18:30-20:00** Welcome party

**Tuesday, September 26, 2017**

**PLENARY SESSION – Chairman Alexander Mukasyan**

**09:15-10:15** Prof. Dan Shechtman (Israel)

Quasi-periodic materials – a paradigm shift in crystallography

**SECTION 1, FLOOR 5 – Chairman A.Levashov**

**10:15-10:45** E.A. Levashov, V.V. Kurbatkina, E.I. Patsera, Yu.S.

Pogozhev, I.V. Iatsyuk, A.A. Zaitsev, Yu.Yu. Kaplanskii

Hybrid SHS-based technologies for design of high-temperature materials

**10:45-11:00** G.F. Tavadze, D.V. Khantadze

Considering Structural Heterogeneity in The Synthesis of Materials

**11:00-11:15** V.N. Sanin, V.I. Yuxhvid, D.E. Andreev, D.M. Ikornikov,

E.A. Levashov, Yu.S. Pogozhev

SHS of cast refractory alloys for reprocessing into micro granules used in 3D additive technologies

**11:15-11:30 Coffee-break**

**11:30-11:45** A.V. Agapovichev, V.G. Smelov, A.V. Sotov, R.R.

Kyarimov

Processing technology of laser welding of combustion chamber elements received by method of selective laser melting

**11:45-12:00** N.F. Shkodich, A.S. Rogachev, S.G. Vadchenko, D.Yu.

Kovalev, A.A. Nepapushev, I.D. Kovalev

Metallic glasses  $\text{Cu}_{50}\text{Ti}_{50}$  by mechanical alloying and their heat-induced structural transformations

**12:00-12:15** O.Odabas, M.Bugdayci, S.Kan, O.Yucel

Investigation of NiB master alloy production via SHS method

**12:15-12:30** Z.Aslamazashvili, G.Zakharov, G.Oniashvili,  
N.Aslamazashvili, G.Mikaberidze, M.Chikhradze, G.Tavadze  
Peculiarities of microstructure of ceramic materials in obtained in TI-B-  
C-N system by SHS

**12:30-12:45** V. V. Sanin, M. R. Filonov, Yu. A. Anikin, D. M.  
Ikornikov, V. I. Yuxhvid  
70Cu–30Fe alloy by SHS metallurgy and thermo-mechanical  
processing

## **SECTION 2, FLOOR 3 – Chairman E.Gutmanas**

**10:15-10:45** E.Y. Gutmanas and I. Gotman  
Dense in situ ceramic and intermetallic matrix composites via pressure  
assisted thermal explosion mode of SHS: from basic research to  
fabrication of structural parts

**10:45-11:00** T.T. Minasyan, S.V. Aydinyan, S.L. Kharatyan  
Selective laser melting of combustion synthesized 2Mo-Cu and 3Cu-  
Mo composites

**11:00-11:15** A. Peikrishvili, L. Kecskes, G. Tavadze, B. Godibadze  
Shock-assisted liquid-phase consolidation of SHS-processed Ta-Al  
based composites

**11:15-11:30 Coffee-break** (Floor 5)

**11:30-11:45** D.O. Moskovskikh, A.S. Mukasyan  
Consolidation/synthesis of ceramic materials by spark plasma sintering

**11:45-12:00** I.V. Iatsyuk, Yu.S. Pogozhev, D.Yu. Kovalev, N.A.  
Kochetov, E.A. Levashov  
Preparation of advanced ZrB<sub>2</sub> based ceramics by SHS, hot pressing and  
spark plasma sintering methods

**12:00-12:15** S.Vorotilo, K.P. Sidnov, V.V. Kurbatkina, E.I. Patsera,  
E.A. Levashov

Density functional theory (DFT) modeling and experimental investigation of the properties of SHS-materials: the case of solid solutions in Ta-Zr-C system

**12:15-12:30** Satbayev B.N., A.I., Shalabayev N.T., Satbayev A.B.  
Experience in testing of high-temperature materials for various components of metallurgical units at enterprises of Kazakhstan

**12:30-12:45** M. Chikhradze, G.Oniashvili, G.Tavadze, G.Mikaberidze, F.D.S Marquis  
Synthesis and adiabatic explosive compaction of Ti-Al-B-C powders

**12:45-13:45 Lunch**

**PLENARY SESSION – Chairman Vladimir Sanin**

**13:45-14:30** Prof. Orest Ivasishin (Ukraine)  
Hydrogen Approach in Powder Metallurgy of Ti and Zr based alloys

**SECTION 1, FLOOR 5 – Chairman O.Yücel**

**14:30-15:00** V.I. Yukhvid, D.E. Andreev, V.N. Sanin, V.A. Gorshkov  
SHS metallurgy of composite materials: basic principles and means of control

**15:00-15:15** G.Zakharov, G.Oniashvili, G.Tavadze, Z.Asalmazashvili, G.Mikaberidze, M.Chikhradze, G. Urushadze  
Development of the technology SHS-metallurgy in Georgia

**15:15-15:30** R.G. Abdulkarimova, K.Kamunur, A.J. Seidualieva, Z.A. Mansurov  
Self-propagating high temperature synthesis of boroncontaining composition materials

**15:30-15:45** G. Xanthopoulou, S.A. Tungatarova, K. Karanasios, T.S. Baizhumanova, M. Zhumabek  
Comparison of the activity of SHS, scs and impregnated catalysts in the reaction of carbon dioxide conversion and oxidative conversion of methane with connection to combustion synthesis parameters



**15:45-16:00** S.Kan, M.Bugdayci, K.Benzesik, O.Yucel  
Production of ferro-molybdenum from domestic resources via  
metallothermic process

**16:00-16:15** S.P. Basag, A. Turan, O.Yücel  
Metallothermic production of antimony

**16:15-16:30 Coffee-break**

**16:30-16:45** A.E. Sytshev, D.Yu.Kovalev, D. Vrel, and S.G.  
Vadchenko  
Self-propagating high-temperature synthesis in the Ni–Al–Nb ternary  
system

**16:45-17:00** D.E. Andreev, S.A. Rogachev, V.I. Yukhvid, and K.G.  
Shkadinskii  
Manifestation of instability arising during SHS surfacing on Ti-  
substrate. Numerical model and experiment

**17:00-17:15** I. V. Saikov, M. I. Alymov, S. G. Vadchenko, and I. D.  
Kovalev  
Shock-wave compaction of metal/fluoropolymer powder mixtures

**SECTION 2, FLOOR 3 – Chairman A.Amosov**

**14:30-15:00** S. Dine, C. Grisolia, G. Peiters, B. Rousseau, N. Herlin, D.  
Vrel

Synthesis of tungsten and tungsten alloys nanoparticles for tokamaks

**15:00-15:15** S. A. Yolchinyan, M. A. Hobosyan, and K. S. Martirosyan  
Particle size dependent pressure discharge properties of  $Al-Bi(OH)_3$   
nano-energetic gas generators

**15:15-15:30** M.K. Zakaryan, S.L. Kharatyan  
Combustion synthesis of Ni-W composite nanopowders from oxide  
precursors

**15:30-15:45** G.I. Ksandopulo, A.N. Baideldinova, L.V. Mukhina, E.A.  
Ponomareva  
Synthesis of inorganic radicals

**15:45-16:00** Yu.V. Titova, A.P. Amosov, D.A. Maidan, A.V. Sholomova, A.V. Bolotskaya

SHS of ultrafine and nanosized powder of aluminum nitride using sodium azide and halide salt  $(\text{NH}_4)_3\text{AlF}_6$

**16:00-16:15** V.V. Kurbatkina, E.I. Patsera, S.A. Vorotilo, N.A. Kochetov, E.A. Levashov

Peculiarities of synthesizing single-phase solid solutions based on tantalum carbide

**16:15-16:30 Coffee-break** (Floor 5)

**16:30-16:45** V.V. Kurbatkina, E.I. Patsera, A.G. Bodyan, E.A. Levashov

New horizon to production of narrow-fraction powders and granules of intermetallides

**16:45-17:00** K. Benzeşik, M. Buğdaycı, A. Turan, O. Yücel  
Production of  $\text{TiB}_2\text{-B}_4\text{C-TiC}$  composite powder mixtures via SHS

**17:00-17:15** H.H. Nersisyan, J.H. Lee, S.H. Lee, J.H. Choi  
Complex hierarchical nano- and microcrystals of  $\text{AlN}$  grown in the combustion wave: microstructural characterisation and growth mechanism

**17:15-18:15 Round Table** - Analysis of publications, development of journals thematically related to SHS etc.

Moderator: E. Levashov

**18:15-20:00 Poster session**

**P1.** Z.Asizamashvili, G.Zakharov, G.Oniashvili, G.Urushadze, G.Mikaberidze, G.Tavadze, M.Chikhradze  
Microstructure peculiarities of metal-ceramic materials of  $\text{Ti-Cr-C}$  system by SHS-compaction

**P2.** N.N. Aghajanyan, S.K. Dolukhanyan, and O.P. Ter-Galstyan

Self propagating high -temperature synthesis of multicomponent carbohydrides in the Ti-Nb-V-C-H system

**P3.** A.P. Amosov, Yu.V. Titova, D.A. Maidan, A.A. Kuzina, I.Yu. Timoshkin, A.V. Sholomova, A.V. Bolotskaya  
Study of introduction of aln nanopowder of SHS-az brand into aluminum melt for ex-situ preparation of composites AL-(1-10%)ALN

**P4.** N.N. Mofa, B.S. Sadykov, A.Ye. Bakkara, Z.A. Mansurov  
Mechanochemical treatment of metallic powders and peculiarities of sh-synthesis of composition systems with their participation

**P5.** L.I. Markashova, G.M. Grigorenko, Yu.N. Tyurin, O.M. Berdnikova, O.V. Kolisnichenko, E.P. Titkov, E.V. Polovetskyi, O.S. Kushnarova  
Functional metal-ceramic coatings: structure and operating properties

**P6.** E.E. Dilmukhambetov, V.N. Yermolaev, S.M. Fomenko, Z.T. Turganov  
Effect of aluminum nanopowders electron beam irradiation on SHS within the silicon oxide - aluminum system

**P7.** S. Tolendiuly, S.M. Fomenko, Ch. Dannangoda, Z.A. Mansurov, K.S. Martirosyan  
Superconducting characteristics of swent doped MgB<sub>2</sub> obtained by combustion synthesis

**P8.** V.A. Gorshkov, P.A. Miloserdov, V.I. Yukhvid and E.G. Grigoriev  
SHS- metallurgy of aluminumoxinitrides for transparent ceramics production

**P9.** E.A. Amosov, E.I. Latukhin, D.Yu. Kovalev, , S.V. Konovalikhin, A.E. Sytshev  
Max compounds by SHS in Ti-Al-C-B system

**P10.** S.V. Konovalikhin, D.Yu. Kovalev, M.A. Luginina, S.G. Vadchenko, A.E. Sytshev and A.S. Shchukin  
Synthesis of a new max phase (Ti<sub>0.5</sub>Zr<sub>0.5</sub>)<sub>3</sub>AlC<sub>2</sub>

**P11.** M.K. Kotvanova, S.S. Pavlova, N.N. Blinova, P.Yu. Gulyaev  
Polyfunctional powder SHS-materials based on oxide bronzes

**P12.** S.N.Kydyrbekova, A.Zh.Seidualiyeva, R.G.Abdulkarimova  
Synthesis of nanostructured composite materials based on zirconium borides

**P13.** M. A. Ponomarev, V. E. Loryan  
Structure formation at consecutive layer-by-layer packing of monodispersed granules

**P14.** M. A. Ponomarev, Loryan V. E.  
SHS in Ti-B and Ti-Al-B structured systems at preliminary warming-up

**P15.** H.A. Mahmoudi, L.S. Abovyan, S.L. Kharatyan  
SHS processing of copper waste into copper powder

**P16.** K. Nazaretyan, H. Kirakosyan, S. Aydinyan, S. Kharatyan  
Nanosized molybdenum carbide synthesized by solution combustion synthesis with subsequent thermal treatment

**P17.** Oglezneva S.A., Saenkov K.L.  
Study of the effect of dispersion powders of nickel and titanium carbide on the structure and properties of diamond tools

**P18.** E.V. Petrov, V.S. Trofimov  
Investigation of coating from powder particles received after high-speed impact

**P19.** Yu.S. Pogozhev, A.Yu. Potanin, A.V. Novikov, N.V. Shvindina, E.A. Levashov  
Ma SHS of advanced biocompatible and bioactive materials in Ti-C-Co/Fe-Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>-Ag-Mg system

**P20.** A.Yu. Potanin, Yu.S. Pogozhev, E.A. Levashov, D.Yu. Kovalev, N.Yu. Khomenko  
The features of MgB<sub>2</sub> thermal explosion synthesis and influence of doping agents

- P21.** D. Sakhvadze, G. Jandieri, I. Bolqvadze, A. Shteinberg, T. Tsirekidze  
Morphological and metallographic analysis of metallic powders produced by the method of hydro-vacuum dispersion of melts
- P22.** V.N. Sanin, D.M. Ikornikov, D.E. Andreev, V.I. Yukhvid, N.D. Stepanov, S.V. Zherebtsov, G.A. Salishchev  
Cold rolling of SHS-produced cast high-entropy alloys Co–Cr–Fe–N–Mn–Al–C: evolution in microstructure and mechanical properties
- P23.** Yu.R. Kolobov, S.S. Manokhin, Yu.E. Kudymova, D.N. Klimenko, V.N. Sanin, D.M. Ikornikov, D.E. Andreev  
SHS-produced cast Ni–Cr–W alloy: structural characterization and mechanical properties
- P24.** A.S. Shchukin, A.E. Sytshev  
SHS joining of W with NiAl: transition zone structure
- P25.** A.S. Shchukin, D. Vrel, and A.E. Sytshev  
Interaction of Ta with Ni–Al intermetallics in a self-propagating high-temperature synthesis
- P26.** O. Thoda, G. Xanthopoulou, V.Prokof'ev, G. Vekinis, A. Chroneos  
Numerical modelling of flame temperature of gel solution combustion synthesis of nanocrystalline nickel-based catalyst and comparison with experimental data
- P27.** Trusov G.V., Tarasov A.B., Moskovskih D.O., Rogachev A.S., Mukasyan A.S.  
Preparation of highly porous metal material based on nickel hollow microspheres by spark plasma sintering
- P28.** G. Xanthopoulou, S.A. Tungatarova, K. Karanasios, T.S. Baizhumanova, Z.T. Zheksenbaeva, M. Zhumabek, G.N. Kaumenova  
Composite materials prepared by self-propagating combustion synthesis for catalytic methane reforming

**P29.** E. Pavlou, G. Xanthopoulou, G. Vekinis  
Multiwave scs regime in the system Mn-Zn-Na-Si-O

**P30.** K. Papadopoulos, A. Marinou, G. Xanthopoulou, G. Vekinis,  
M.Karakasidis  
Soot oxidation using chromium-based scs catalysts applied on a  
magnesia-spinel carrier by flame spraying

**P31.** G.Zakharov, G.Oniashvili, G.Tavadze, Z.Aslamazashvili,  
G.Mikaberidze, I.Bairamashvili, N.Djalabadze  
SHS ferroboron ligature

**P32.** V.V. Zakorzhevsky  
Influence of oxygen impurity on  $\alpha$ -phase content at SHS of  $Si_3N_4$

## **Wednesday, September 27, 2017**

### **SECTION 1, FLOOR 5 – Chairman A.Sytchev**

**10:00-10:30** D.V. Shtansky, E.A. Levashov, Ph.V. Kiryukhantsev-  
Korneev, K.A. Kuptsov, A.N. Sheveyko  
SHS in surface engineering

**10:30-10:45** O. Odawara  
SHS and related technologies applied to developments in underwater  
environment

**10:45-11:00** Yu.S. Pogozhev, E.A. Levashov, D.V. Shtansky, E.I.  
Patsera, V.V. Kurbatkina, A.Yu. Potanin, A.V. Novikov, F.V.  
Kiryuhantsev-Korneev  
SHS of multicomponent targets and their application in magnetron  
sputtering of functional coatings

**11:00-11:15** O.K. Kamynina, S.G. Vadchenko, A.S. Shchukin, I.D. Kovalev  
SHS surfacing of Ti and Ta substrates

**11:15-11:30** E. I. Latukhin, A. P. Amosov, A. M. Ryabov, A. Y. Illarionov, V. A. Novikov  
Interaction of molten metals with porous skeleton of  $Ti_3SiC_2$  max-phase in SHS conditions

**11:30-11:45 Coffee-break**

**11:45-12:00** L. Chlubny, J. Lis, P. Borowiak, K. Chabior, K. Kozak, A. Misztal  
Effect of addition of excess silicon on SHS synthesis of  $Ti_3SiC_2$  max phases powders

**12:00-12:15** Shyan-Lung Chung and Jeng-Shung Lin  
Combustion synthesis of h-BN and its applications in high thermal conductivity polymer composites

**12:15-12:30** A. Huczko, A. Dąbrowska, M. Fronczak, M. Bystrzejewski, D. P. Subedi, B. P. Kafle, R. Bhatta, P. Subedi, A. Poudel  
Combustion synthesis of novel nanocarbons via processing of magnesium-containing compositions

**12:30-12:45** Mansurov Z.A., Fomenko S.M.  
Peculiarities of aluminothermic combustion of oxide systems under high nitrogen pressure

**SECTION 2, FLOOR 3 – Chairman G.Xanthopoulou**

**10:00-10:30** O. Thoda, G. Xanthopoulou, G. Vekinis, A. Chroneos  
Development of solution combustion synthesis technology for nickel-based hydrogenation catalysts

**10:30-10:45** S.I. Roslyakov, A.S. Mukasyan  
New phases by solution combustion synthesis

**10:45-11:00** L. Trombi, R. Rosa, P. Veronesi, C. Leonelli  
On the versatility of microwaves ignition in solution combustion synthesis: the case of nickel nitrate – glycine system

**11:00-11:15** Trusov G.V., Tarasov A.B., Roslyakov S.I., Rogachev A.S., Mukasyan A.S.

A novel preparation technique of metal and metal oxide hollow microspheres by spray solution combustion synthesis

**11:15-11:30** A. Marinou, O. Thoda, G. Xanthopoulou, G. Vekinis  
Ni-Based catalytic coatings synthesized by in-flight scs during flame spraying

**11:30-11:45** **Coffee-break** (Floor 5)

**11:45-12:00** S.S. Kaplan, B. Derin, O. Yucel – M. S. Sonmez  
Solution combustion synthesis of tungsten trioxide

**12:00-12:15** V. Novikov, G. Xanthopoulou, Yu.Knysh  
Single step preparation of Cu-Cr-O and Ni-Cr-O nano catalysts for Co oxidation by solution combustion synthesis

**12:15-12:30** E. Yilmaz, B. Derin, O. Yucel, M. S. Sonmez  
Solution combustion synthesis of vanadium oxide by glisin and citric acid

**12:30-12:45** A.A. Kondakov, A.V. Linde, I.A. Studenikin, V.V. Grachev  
Synthesis and decomposition of max phase  $Ti_2AlN$  in the mode of filtration combustion

**12:45-13:15** **Closing ceremony**

**13:15-14:15** **Lunch**

**14:15-19:00** **Excursion to Mtskheta**

**19:00-22:00** **Banquet**



## **Thursday, September 28, 2017**

**09:30-19:00** Excursion to Kakheti (Signagi, Winery-Khareba) &  
Dinner

## **Friday, September 29, 2017**

**09:00-22:00** Discussion of collaborative programs/ visiting the  
Institutes and Universities/ Self-organizing cultural events/Departure