



УКРАЇНА  
МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ  
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ  
«ХАРКІВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ»  
ЄВРОПЕЙСЬКИЙ ОСВІТНЬО-НАУКОВО-  
ТЕХНОЛОГІЧНИЙ ЦЕНТР

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## Cooperation proposal

**From:**

Department "Welding"

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**To:**

Dr. Head of the laboratory of self-propagating high-temperature synthesis – senior researcher Georgy Mykaberidze, giorgimikaberidze1@gmail.com

Ferdinand Tavadze Institute of Metallurgy and Materials Science

### CREATION OF COMPOSITE MATERIALS FOR SURFACING AND GAS-THERMAL SPRAYING, SYNTHESIZED USING SELF-PROPELLING HIGH-TEMPERATURE SYNTHESIS (SHS)

#### **Brief description of scientific research:**

The creation of new composite materials that provide increased durability and reliability of various machine parts and mechanisms under conditions of intense wear, exposure to high voltages, temperatures, and aggressive environments is an important problem for all branches of mechanical engineering, while taking into account energy and resource saving factors is decisive.

One of the most effective ways to solve this problem is the use of self-propagating high-temperature synthesis (SHS) technology. Currently, this technology has been developed in advanced foreign countries.

In this regard, it is proposed to conduct joint research on the creation of composite materials that provide increased wear resistance of reinforcing or restorative coatings for machine parts operating in an abrasive environment.

#### **Description of the direction of research**

Using the research experience of Georgian and Ukrainian scientists in the field of synthesizing new composite materials using the method of self-propagating high-temperature synthesis (SHS), to create materials and technology for their application on the surfaces of machine parts subject to intense wear during operation in an abrasive environment.

Within the framework of the project, it is proposed, together with scientists from the laboratory of self-propagating high-temperature synthesis of the Ferdinand Tavadze Institute of Metallurgy and Materials Science, to carry out the following research:

- analyze the technological features of producing composite materials using the SHS method and, on their basis, propose a new approach to increasing the service life of machine parts;
- to develop composite materials based on powder materials used for surfacing and gas-thermal spraying by modifying them with material synthesized using the SHS process;
- study the influence of the modifying material on the structure and microhardness of the coating;
- conduct tribological studies of the developed coatings;
- to develop a technology for strengthening standard machine parts by surfacing and gas-thermal spraying with developed composite materials.

### **Relevance and novelty:**

The theoretical result of the research will be the substantiation of the production of a modifying material using the SHS process for arc surfacing and gas-thermal spraying. Results of a study of the structure, composition and nature of the distribution of solid inclusions of the modifying material in the matrix material, tribological properties of the composite coating material.

### **Purpose and expected results:**

The practical significance of the work involves the creation of energy- and resource-saving technologies for the self-propagating synthesis of new composite materials for arc surfacing and gas-thermal spraying, which have high wear resistance when operating machine parts in an abrasive environment.

The technical result of the effectiveness of using the developed composite materials at enterprises in Georgia and Ukraine is to increase the service life of new and restored machine parts due to the lower wear rate of composite coatings.

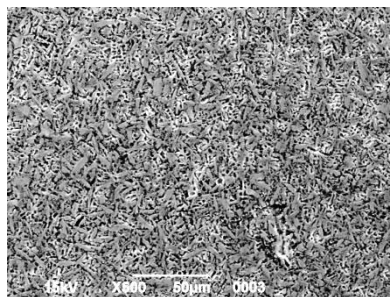
Based on the results of the research, it is planned to publish articles, issue patents for the developed composite materials and methods for their production, and participate in competitions for joint Ukrainian-Georgian scientific projects.

### **Experiment and research results:**

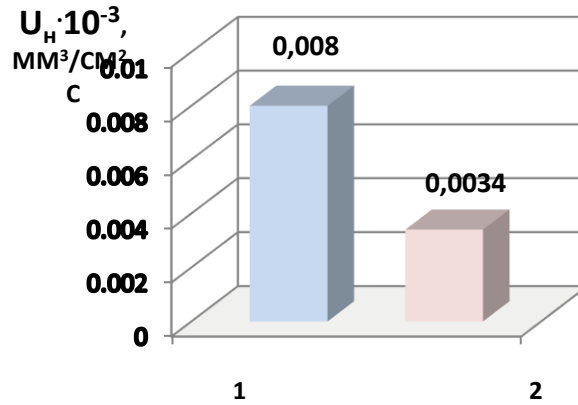
In this direction, under the leadership of Professor S. Luzan, work is being carried out to obtain composite materials using the SHS process. Research is being conducted on the issues of determining the composition of the composite material, the technology of its synthesis using the SHS process, and methods of introducing it into the matrix material - nickel-based powder of the Ni-Cr-B-Si system. Metallographic and tribological studies of the created composite materials were carried out.



**SHS formation process composite material**



**Microstructure of deposited coatings with composite material**



### Increasing the wear resistance of a deposited coating containing a composite material

#### Список базових публікацій:

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4. S. O. Luzan, V. A. Bantkovskiy, and A. S. Luzan, Tribological Properties of Composite Coating Ni-Cr-B-Si-Boron-Containing Dispersed Phases Obtained by Arc Surfacing, at Abrasive Action and Sliding Friction, *Metallofiz. Noveishie Tekhnol.*, 44, No. 4: 531-547 (2022) (in Ukrainian). DOI: 10.15407/mfint.44.04.0531
5. Патент № 133419, Україна, МПК (2019.01) С22С 14/00, В22F 1/00. Шихта для отримання композиційного зносостійкого матеріалу з використанням СВС-процесу / С.О. Лузан, О.І. Сідашенко, А.С. Лузан – Опубл. 10.04.2019; Бюл. № 7.
6. Патент № 143297, Україна, МПК (2020.01) С22С 14/00, В22F 1/00. Спосіб одержання композиційного матеріалу на основі сплаву системи Ni-Cr-B-Si / С.О. Лузан, О.І. Сідашенко, А.С. Лузан – Опубл. 27.07.2020; Бюл. № 14.

**P.S.** If you are interested in carrying out joint work, I propose to agree on a research plan and draw up an agreement on creative cooperation.

Head of the "Welding" department

Serhiy LUZAN

