SCIENTIFIC AND BUSINESS COOPERATION AGREEMENT

Between

LEPL G. Tsulukidze Mining Institute
Tbilisi, Georgia
represented by
Prof. Dr. Eng. Nikoloz Chikhradze
Director

and

LEPL Ilia Vekua Sukhumi Institute of Physics and Technology
Tbilisi, Georgia
represented by
Prof. Dr. Guram Bokuchava
Director
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and

Project Center for Nanotechnology and Advanced Engineering (PC-NAE)
a joint initiative of the
Greek National Center for Scientific Research "Demokritos"
and
Russian Research Center "Kurchatov Institute"
Athens, Greece
represented by
Academician Prof. Dr-Ing, Dr.h.c. Prof.h.c. Athanasios G. Mamalis
Project Scientific Director

Representing the Shockwaves Cluster established between:

- School of Materials Science and Engineering, Georgia Institute of Technology, USA
- Nordmetall GmbH, Germany
- Shock Wave and Condensed Matter Research Center, Kumamoto University, Japan
- Project Center for Nanotechnology and Advanced Engineering, Greece

Operating under the auspices of the duly signed Scientific and Business Cooperation Agreement attached herewith as an appendix.

1. Fields of cooperation

1.1 Theoretical and Practical aspects of **Explosive processing of materials** and **Shock-Wave propagation**. Impact and crash testing; numerical modeling, simulation and optimization of low and high strain-rate processing (forming and metal removal) and the constitutive behavior of materials (metals, polymers, ceramics, composites, bi-materials and nanomaterials).

1.2 **Precision and Ultra precision Manufacturing** of metallic and non-metallic (ceramics, polymers, composites etc.) materials from macro-, micro-, to nanoscale, related to the tendency to miniaturization, accompanied by the continuous increasing of the accuracy of the manufactured parts.

1.3 **Nanotechnology Processing** employing new advanced energy beam processes. Design and manufacture of **Nanostructured Materials**, exhibiting novel and significantly improved optical, chemical, mechanical and electrical properties; in particular:

- **Nanoparticles**, possessing larger active surfaces per unit volume and mass, exhibiting greater chemical activity, especially when treated under shock. They can be used as materials for aerospace, magnetics, semiconductors, catalysts and biocompatible implants.
- **Nanostructured Layers** for the development of a new generation of cutting tools (nanocomposites on hard substrates), produced by Laser Melt Injection Technology. The cooperation can be in producing the layer, its evaluation from point of view of microstructure (nanostructure) and real performance.
- **Nanocomposites.**

1.4 **Powder Processing (Static, Dynamic and Shock loading)** of metals, ceramics and their mixtures, magnetics semiconductors and superconductors, from macro-, micro-, to nanoscale, including:

- Wire Explosion techniques, for producing nanomaterials.
- High Energy Rate compaction (explosive, electromagnetic and ultrahigh pressure techniques) of the above mentioned materials.
- Manufacture of nanostructured billet, rod and sheet semi-products from different materials using explosive compaction technologies.
- Development of advanced techniques by which the initial grain structure, the parameters of the forming procedure (temperature, strain rate, lubricant material and die geometry) and the characteristics of the semi-product (microstructure, physical and mechanical properties) can be functionally connected together with advanced numerical modeling techniques using FEM explicit and implicit codes.

1.5 Specific topics in **Energy** and **Environment** (superconductors, semiconductors, magnetics, multifunctional materials) and **Transportation** (Crashworthiness of Vehicles, i.e. materials and structures), pertaining to the Aircraft and Automotive Industry (electric/hybrid vehicles).

2. Materialization

Whereas the above named institutions recognize that cooperating would be of mutual benefit and would serve as an indication of continued interest in joint research and industrial activities, it is agreed the institutions will explore:

- Joint submission of collaboration proposals to EU research programs, United States, European and other agencies and industry worldwide.
- Exchange of scientists for extended visits to work on joint research projects.
- Joint publications, workshops, presentations at conferences and other activities to promote technical exchanges and dissemination of research results.

3. General regulations

- The cooperation partners are equal partners, who organize and carry out their tasks according to their own expertise independently. The measure of the intellectual properties and know-how created during the common R&D work will be determined in separate contracts.
- The distribution of the tasks of each project as well as financing the tasks will be defined in separate contracts.
- Nothing in this Cooperation Agreement shall be deemed or implied to create joint venture or partnership or any kind between the Parties. No Party shall have the right to contract on behalf of or bind the other party or make any commitment, representation or warranty for or on behalf of the other Party. Each Party retains all right, title and interest in its intellectual property including without limitation inventions, whether or not patented, copyrights, data, trademarks, trade secrets, and know-how, and nothing herein shall be construed to grant any right, license, or interest to such intellectual property.

- Involvement of outer partners into the cooperation activities can be realised on the base of common agreement of the cooperating partners of the present contract.
- The way of publication of the results of the common R&D activities will be determined commonly by the cooperation partners.
- This Cooperation Agreement created for undetermined duration under the condition that each partner has the right to abrogate the contract in writing notifying the other partners in advance. It will become effective on the final date of signature.

4. Research collaboration

The cooperation partners will initiate the proposed collaborative activities contingent upon successful negotiation and execution of appropriate agreements at a later date, which shall outline the terms and conditions applicable to each activity and Greece and Georgian laws and regulations.

5. Confidentiality

Proprietary or confidential information may be exchanged once a mutually agreeable Non-Disclosure Agreement has been executed and export approval has been obtained, if applicable.

Prof. Dr. Eng. Nikoloz Chikhradze
Director
LEPL G. Tsulukidze Mining Institute

Date: November 7, 2018

Prof. Dr. Guram Bokuchava
Director
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