LEPL GRIGOL TSULUKIDZE MINING INSTITUTE

LEPL GRIGOL TSULUKIDZE MINING INSTITUTE

General Information

G. Tsulukidze Mining Institute (TMI) was founded in 1957 under Academy of Sciences of Georgia. Since 2006 the Institute is independent and has status: Scientific- Technological Institute, legal entity of public law.

Departments and Laboratories:

1. **Department of Underground Structures Construction, Mining and Complex Mechanization:**
   a) Laboratory of Underground Structures Construction;
   b) Mining Laboratory;
   c) Laboratory of Complex Mechanization.

2. **Department of Blasting Technologies:**
   a) Laboratory of Explosives Research and Blasting Technologies;
   b) Laboratory of High-Tech Materials;
   c) Laboratory of Explosion Protection Technologies.

3. **Department of Rock, Construction Material Properties and Quality Control.**
4. **Department of Analytical Chemistry and Mineral Processing.**
5. **Research Center of Engineering Developments and Design.**

Contact Information:

Dr. Nikoloz Chikhradze
Director
7, E. Mindeli Str., 0186, Tbilisi, Georgia
Tel./Fax: +(995 32) 2324716/+(995 32) 2325990
E-mail: tmi@mining.org.ge
Web-site: www.mining.org.ge

The main directions of scientific and technical works of the Institute are as follows:

1. Improvement of construction and reconstruction of mining, transport, hydroengineering and other structures, development of technologies for sound and economical driving of tunnels and support structures.
2. Study of the stressed-strained state of the rock mass around mine workings and underground structures and perfection of its assessment methods.
3. Development of calculation methods of static, rheological/flow and dynamic loads of mine workings and underground structures, their computer programs and technical guidelines; application of those in specific projects.
4. Improvement of design methods for opening and development of sheet and vein deposits.
5. Research and development of a technology for mining deep levels of thick coal seams under difficult mining and geological conditions.
6. Development of methods for complex utilization of manganese deposits.
7. Development of pipe-line hydro-transportation systems (water lines, pulp-lines, oil and gas pipelines) safe and reliable operation complex events; elaboration of pipelines, pipeline valves and other equipment condition technical diagnostics.
8. Pipelines electricity transportation system, transient regimes, non-stationary processes investigation and hydraulic impacts protecting effective means and ways development to ensure increasing level of system safety operation, reliability, ecological cleanness.
9. Elaboration of pipelines and equipment hydro-abrasive wear investigation and reducing effective means and ways.
10. Diagnostics of the ropeway transportation means, lifting transport devices and mechanisms.
11. Pipe-line hydro-transportation systems (water lines, pulp-lines, oil-, oil products- and gas pipelines) calculation, projecting, construction, operation, expertise and monitoring problems related issues.
12. Creation and research of new plasma technology for melting of ferrous and nonferrous metals for refractory and sound materials, industrial waste and materials used in the military industry (projectiles, armors, etc.) and equipment necessary for its implementation.
13. Projecting, modeling, calculation and expertise of ropeways and similar roping and axial systems.

14. Development of novel environmentally friendly explosives.
15. Research of the seismic effect caused by a single blast and development of techniques for reducing its harmful impact on engineering structures.
16. Perfection of blast operations in densely populated areas for reducing their harmful effect on natural and historic treasures.
17. Development of computer programs for determining optimal parameters of drilling and blasting operations.
18. Development of explosive compacting, hardening, welding and synthesis technologies.
19. Development of superhard materials production technology using shock waves and high initial temperatures.
20. Development of technologies for production of nanostructural composite materials;
21. Analysis and elaboration of methods for calculation of dynamic loads caused by explosion.
22. Development of systems for protection people and mining objects from explosion effect.
23. Systems for protection collieries from methane and coal dust explosion.
24. Establishment of properties of rocks and building materials and quality control.
25. Development of a novel sound-damping and low-heat building materials production technology and research methods.
26. Calculation and design of underground constructions and tunnels.
27. Chemical analysis of ores and their concentrates.
28. Analysis of water and soil (except of microbiological).
29. Technological testing of metallic and nonmetallic minerals by mechanical (gravitation, magnetic and electrostatic separation, flotation) and chemical (hydrometallurgy) methods for assessment of deposit economic potential.
30. Improvement of current technological processes of mineral dressing and retreatment of mine tailings.
31. Environmental problems of mining industry.

Facilities

The Institute has an underground experimental base for testing explosives with up to 100 kg of the TNT equivalent. Other equipment includes presses (TechPress2TM hydraulic-pneumatic automatic mounting press), test benches, optical microscopes, X-ray diffraction system X1 (Scintag, USA), and metallographic, chemical and diagnostic laboratory equipment.

Scientific Cooperation and Technology Transfer

The Mining Institute has close international scientific collaboration with research centers and Institutes of EU Countries: Germany (Clausthal University of Technology), Greece, Netherlands, Poland, Spain, Bulgaria, Czech Republic; USA (Los-Alamos National Laboratory, US Army Research Laboratory, Lawrence Livermore National Laboratory, Georgia Institute of Technology, South Dakota School of Mines and Technology, University of San Diego); Russia (Semenov's Institute of Chemical Physics in Chernogolovka, Institute of High Pressure, Novosibirsk Institute of Hydrodynamics); Ukraine (Institute of Nature Management Problems and Ecology National Academy of Sciences of Ukraine, Dnipropetrovsk, Paton's Institute of Electrical Welding, Dnipropetrovsk State Design Bureau "Yuzhnoye" etc.), etc.

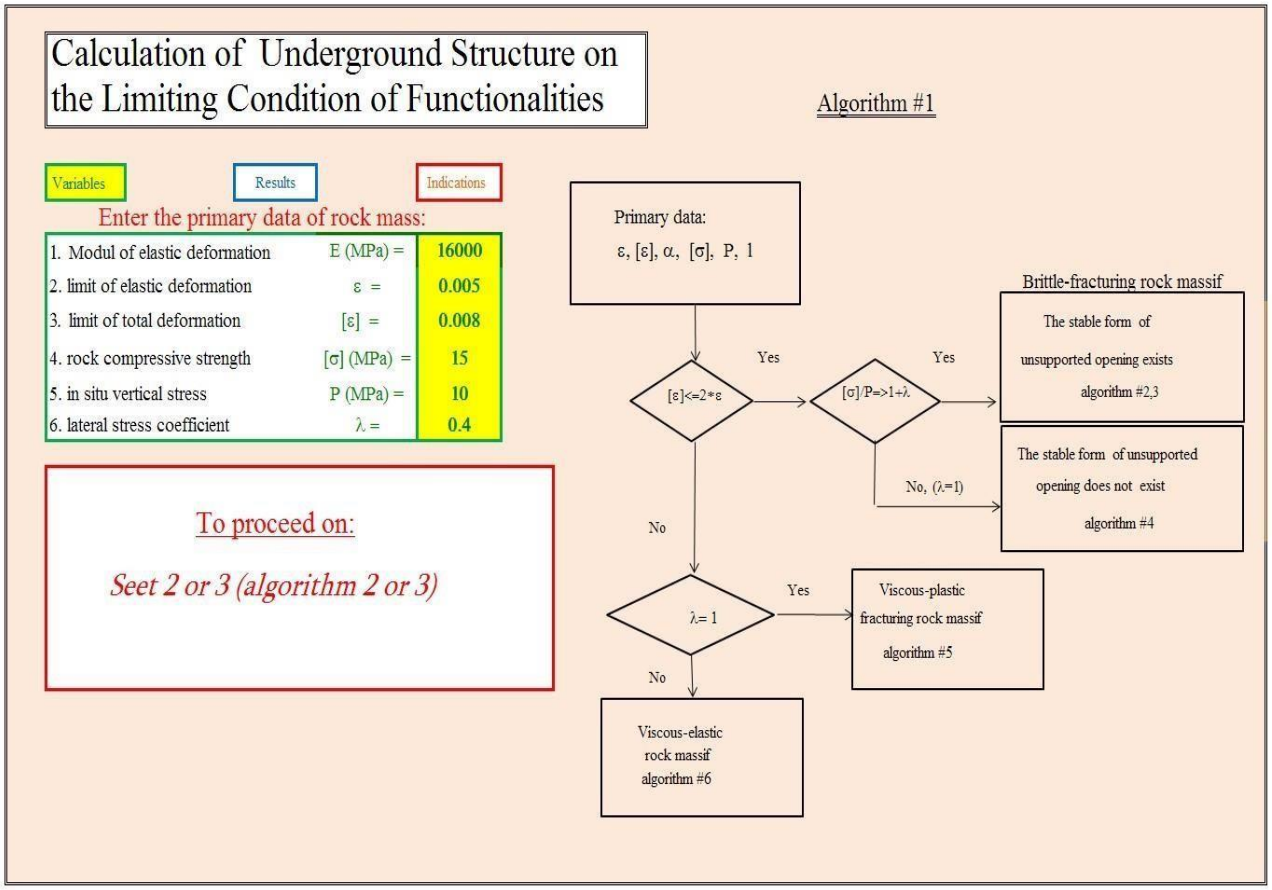
Participation in Scientific Projects

sulukidze Mining Institute has participated in a number of scientific projects funded by Shota Rustaveli National Science Foundation (Georgia), International Science & Technology Center (ISTC), Science and Technology Center in Ukraine (STCU), US Civilian Research & Development Foundation (CRDF), Georgian Research and Development Foundation (GRDF), NATO Science for Peace and Security Programme (SPS), International Association for the promotion of cooperation with scientists from the independent states of the former Soviet Union (INTAS), Japan International Cooperation Agency (JICA).

LABORATORY OF UNDERGROUND STRUCTURES CONSTRUCTION

Calculation on limiting states of operational ability of underground structures of mining, transport, hydro engineering, defensive and other purposes on static and dynamic loadings.

The computing methods, developed in Institute, allow receiving optimal from the technical and economic point of view of the decision of the project of underground structure with taking into account of elastic-plastic and creep properties of a massif and elements of support, and also main factors of construction technology.



Contact Information:

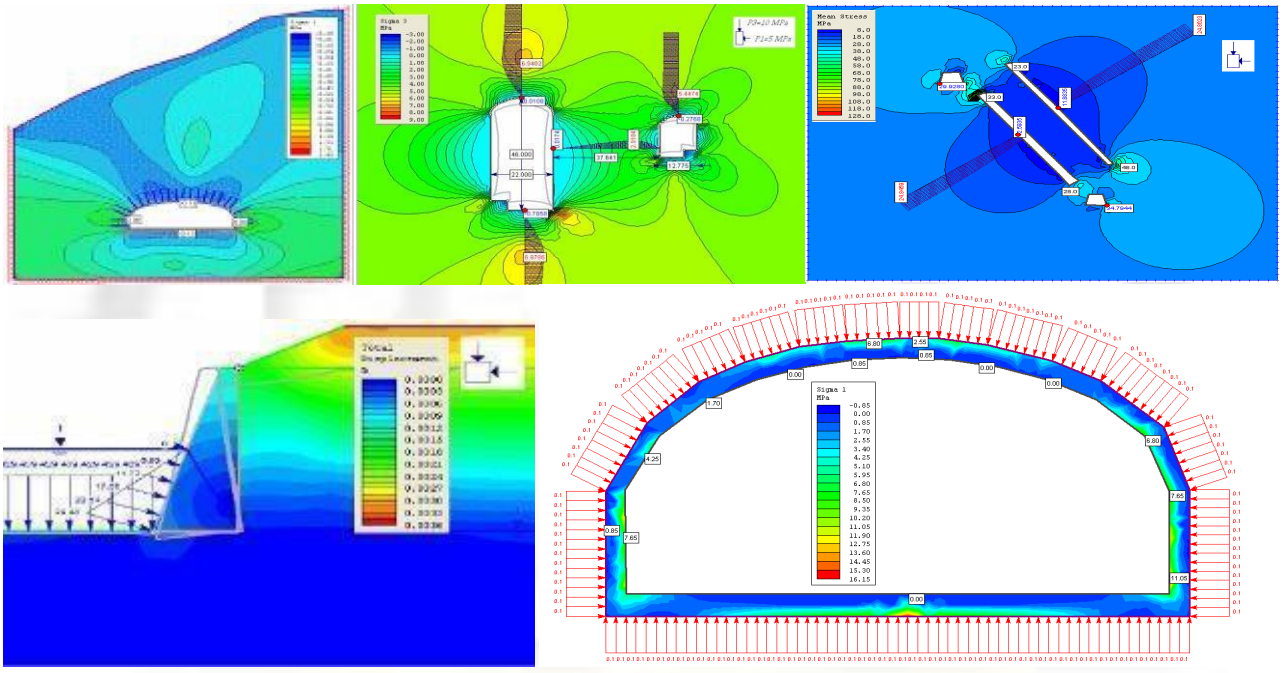
Head of department, Head of laboratory, Prof. *Levan Japaridze*, Dr.Eng
Tel.: +(995 32) 2325831
E-mail: ljaparidze@mining.org.ge
levan@grdf.ge

LABORATORY OF UNDERGROUND STRUCTURES CONSTRUCTION

An estimation of the stress-deformed states and designing of various types of the mining and technical structures with use of the modern specialized computer programs ("Rocscience" - "Pase2", "Lira" ets.):

- Assessment of the stress-deformed states of the heterogenous rock massif around openings of mines;
- Calculation of the mining, transportation, hidraulic engineering, defense or other facilities of complex forms of the cross sections;
- Projection and evaluation of the slopes at the mining, transport, civil engineering and other works.

These tools and methods can be used for optimal design of specific objects of various purposes, shape, number and mutual arrangement.



Contact Information:

Head of department, Head of laboratory, Prof. *Levan Japaridze*, Dr.Eng
Tel.: +(995 32) 2325831
E-mail: ljaparidze@mining.org.ge
levan@grdf.ge

Polymeric Composite on the Basis of Hybrid Fibers

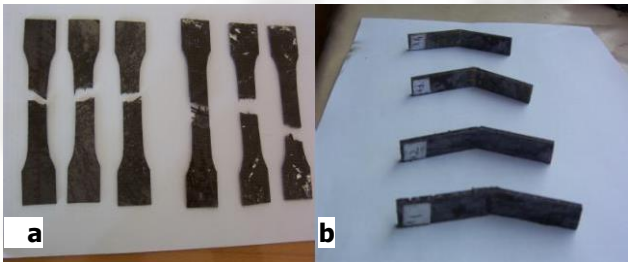
Description

The composite with a matrix from epoxy resin and reinforcing structures from hybrid fibers (glass, carbon, basalt) is proposed. The possibility for partial replacement of high-strength and high-modulus carbon fiber by basalt one without a marked impairment of composite physical-mechanical properties is shown. Basalt fiber, used in the composite, is prepared from Georgian raw material and is characterized by low content of ferrous oxides and by moderate simplicity of the technology for its preparation. Boron carbide and basalt, as the strengtheners of polymeric matrix are used in the form of the powders, prepared by the technology, elaborated by us.

Composite is fabricated by autoclave method of molding, which is characterized by a number of advantages in comparison with other methods, in particular, with “wet” method, when an impregnation of reinforcing components and further molding of the material are carried out simultaneously. These advantages lie in the fact that at preliminary impregnation and fabrication of semi-finished product-prepreg the practically total wetting of the fiber by a binder and rigorous control of its content in the composite is possible.

Areas of application

- Renewable Energy and Energy conservation Technologies (Elaboration of above-described composites, dedicated for fabrication of the case and longeron of wind turbine, executed by us in the frame of the project STCU N G-3631 manager – N.P. Ushkin);
- New Materials and Nanotechnology;
- Aerospace;
- Nuclear Energy and Safety.



Composite samples after testing on tension (a) and bending (b)

Stage of Development

Conceptual stage of the technology for fabrication of the material and the stage of development have been passed (full-scale laboratory testing were carried out). The analysis of technical feasibility was performed too, prototypes of material and products for testing were obtained. At present the procedure of patenting is carried out in Agency “Georgian Patent”. Agreement with Ltd ”Elita” -with a future probable partner in the problem of fabrication and realization of new production from basalt - , glass - , carbon plastic, among them are the blades of wind turbine was reached. For practical realization of this aim the financial support is necessary.

Contact Information:

Senior Research Fellow,
Prof. Guram Abashidze, Dr.Eng.
Tel./Fax: +(995 32)324716/+(995 32)325990
E-mail: abashidze@mining.org.ge

LABORATORY OF UNDERGROUND STRUCTURES CONSTRUCTION

Fabrication of New Composite Materials by Explosive Consolidation

Description

Fabrication of composite materials is based on preparation of mixture of metal and ceramic powders and their explosive consolidation to obtain solid material. The powders of different purpose are used: matrix (copper, aluminum, iron), radar -absorbent and radioresistant (boron, boron carbide, tungsten, tungsten boride, gadolinium), corrosion -proof (nickel, chrome, yttrium). Production of multifunctional material is available as well.

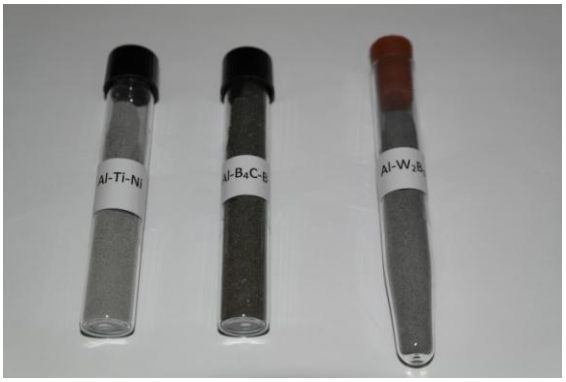
To obtain powder grains of right size the „Fritch" high -energy mill has been used, which ensure preparation of homogeneous nano-, ultra-, polydispersed mixtures. In some systems (for example, Ti–Al–Ni) fabrication of nanostructured and amorphous intermetallics by means of this mill can be achieved.

Explosive consolidation is used for both cold and hot mixtures, by means of determinating and keeping corresponding parameters of explosion in each particular case.

Main advantages/Innovation aspects:

- Availability of materials with preset properties;
- Multifunctionality of obtained composite materials.

.



Powder mixture prepared in „Fritch" high–energy mill

Samlpes fabricated by explosive consolidation from powder mixture placed in cylindrical ampoules

Areas of application:

Electronics, energy industry, flight and space technologies, medicine, machinery-producing industry, chemical industry.

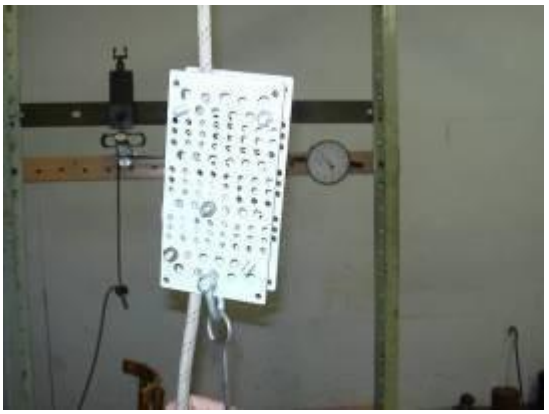
Contact Information:

Senior Research Fellow,
Prof. Guram Abashidze, Dr.Eng.
Tel./Fax: +(995 32)324716/+(995 32)325990
E-mail: abashidze@mining.org.ge

LABORATORY OF ROPE SYSTEMS

The Cable Evacuation Device Equipped with the Automation Adjustment System of Speed Admission

Description



The scientific group of the Department of Transportation of Special Types, Reliability and Diagnostics of the Mining Institute in 2004 obtained the first results during work on the above-mentioned problem. In 2008 as a result of these investigations it was elaborated an original evacuation device, an experimental specimen was created and theoretical investigation and laboratory tests were conducted that persuasively showed that it was possible on the basis of the elaborated original design to manufacture a beneficial and competitive product for mass production – automatic cable evacuation device.

The main distinctive property of the device from the existing ones is in the automatic adjustment mechanism of evacuation speed that provides a fast evacuation of people.

Innovative Aspect and Main Advantages

The main distinctive property of the device from the existing ones is in the automatic adjustment mechanism of evacuation speed that provides a fast evacuation of people.

Areas of Application

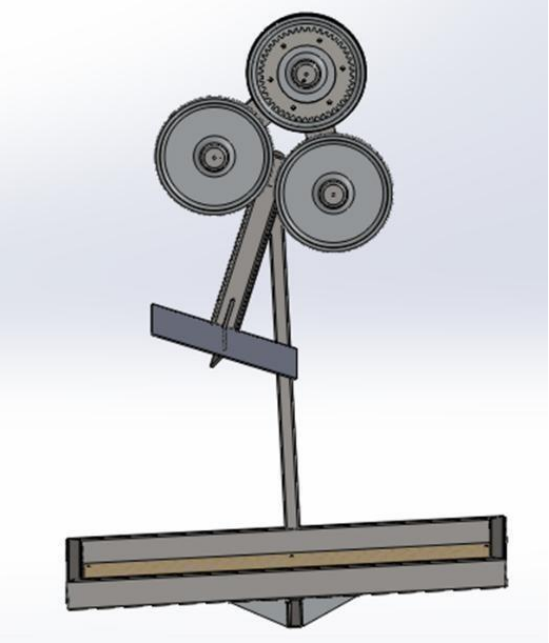
- In the military sphere – during fast and safe landing of troops and cargoes from helicopters. One must note that during landing the soldier on rope is given a full possibility to take active part in combat as the landing can be implemented in automatic mode;
- During implementation of various high-rise vertical assembly work;
- For safe evacuation of passengers from moving cable cars;
- For evacuation of people from high-rise buildings and engineering installations in emergency cases (for example: fires, terrorist actions, earthquakes and disasters of other types) when the implementation of rescue operations of other types is impossible or is extremely limited;
- In the extreme kinds of sports – mountain climbing, vertical speleology, canyoning, jumping etc. – during vertical descending.

Stage of Development

A test specimen has been manufactured and tested in laboratory conditions

Contact Information:
Head of Laboratory,
Dr. *Giorgi Nozadze*
Tel.: +(995 32) 2326991
E-mail: g.nozadze@mining.org.ge
g_nozadze@yahoo.com

Self-propelled Ropeway with Small Weight



Presented self-propelled ropeway with small weight can be used in difficult terrain with a variety of places and make the material shipping in destination.

Ease of installation and low cost is main priority of self-propelled ropeway.

This product is ready to produce a for of the trial installation.

With the help of sponsors may be set up mobile transportation equipment for use in mountainous regions.

The ropeway technical specifications:

Capacity: 100 -200 kg;

transport distance: unlimited;

cable diameter: 12-16 mm;

Max. Elevation angle of trajectory: 30 - 40º;

transportation speed: 0.7 - 1 m / sec.

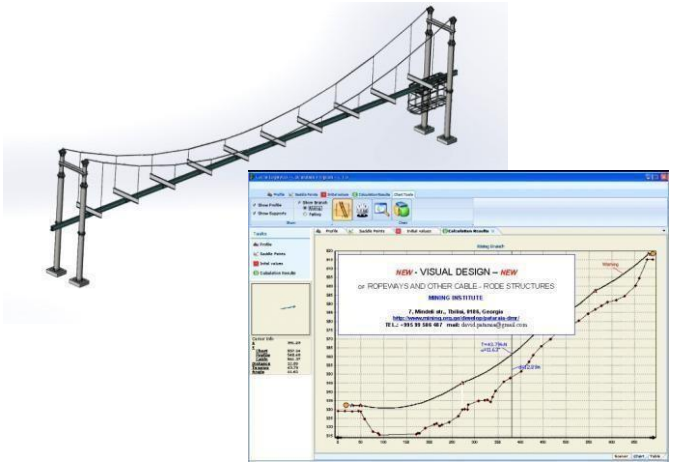
Contact Information:

Head of Laboratory,
Dr. *Giorgi Nozadze*
Tel.: +(995 32) 2326991
E-mail: g.nozadze@mining.org.ge
g_nozadze@yahoo.com

LABORATORY OF ROPE SYSTEMS

Safety analysis, expertise, computer modeling and design of ropeway transport systems, suspension bridges and metal constructions for touristic, agricultural, industrial and defensive purpose

1. Safety analysis, computer modeling and design of ropeway and rope - rodstructures



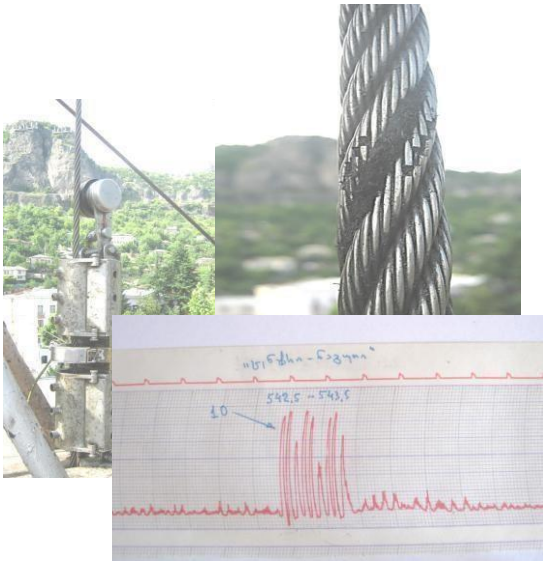
According to the legislation ropeway transport belongs to the high-risk facilities, which should undergone so-called mandatory safety analysis. The results of analyses and recommendations should be fixed in an official document - Safety Report. Software program based on original approach is developed In the laboratory on the basis of which Safety analysis, computer modeling, design and calculation of ropeway, suspension bridges and other widespread constructions are conducted. Developed Mathematical and Software programs have international recognition.

(http://www.mining.org.ge/develop/pataraia-dmr/index.html)

The laboratory employees are certified according to the European regulations - "Cableways- modern EU norms and safety analysis " to perform appropriate expert works.

2. Instrumental defect detection and expertise of rope ways and rope - rodstructures

For the purpose of providing safety and effective exploitation of passenger and cargo ropeways visual and instrumental methods of expertise are developed in the laboratory for carrying and trucking ropes and related nodes, electronic and mechanical equipments. The laboratory is equipped with modern measuring and diagnostic equipments. This is a traditional direction and it is operating successfully in the institute since its foundation.

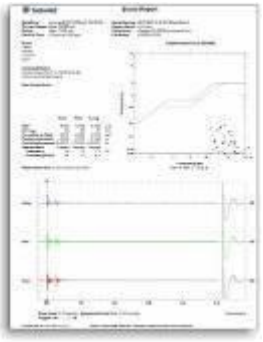


Contact Information:

Head of Laboratory,
Dr. *Giorgi Nozadze*
Tel.: +(995 32) 2326991
E-mail: g.nozadze@mining.org.ge
g_nozadze@yahoo.com

LABORATORY OF EXPLOSIVES RESEARCH AND BLASTING TECHNOLOGIES

- Testing and expertise of explosives and explosive facilities;
- Selection of protective technologies for blasting operations;
- Designing drilling and blasting operations for new and producing opencasts;
- Designing blasting operations under construction of underground structures of various applications.



- Designing explosive disassembly of engineering structures;
- Seismically safe masses of charges and distances;
- Development and monitoring of adverse effect of blasting operation mitigation measures.
- Designing of opencast mining;
- Stability calculation of opencasts and dumps under impact of static and dynamic loadings;
- New resource saving technology for mining of facing blocks.

Contact Information:

Acting Head of department,
Davit Khomeriki
Tel./Fax: +(995 32) 2328191/+(995 32) 2326887
E-mail: davitkhomeriki@yahoo.com

LABORATORY OF EXPLOSIVES RESEARCH AND BLASTING TECHNOLOGIES

New Type Industrial Explosive

Description

In the republics of the former Soviet Union, including Georgia, great volume of gunpowder and solid jet fuel utilized from up-to-date ammunition which should be definitely destroyed, has been accumulated. Nowadays in practice there are two ways of their destruction: explosion and burning. Both of them are connected with economic expenses as well as with ecological problems. In the advanced states special plants are used for their utilization, where destruction of these materials is realized.

Traditional ways of problem solution imply creation of new explosive materials on the base of application of ingredients possessing better properties. In distinct from the traditional methods the essence of the offered technology is creation of new type of industrial explosive compounds and application of fuel removed from utilized missiles/shells of military designation in the role of components of explosive materials. Such an approach, on the one hand simplifies the economic and ecological problems connected with destruction of obsolete missiles. On the other hand such an approach will contribute to sharp decrease of price of industrial explosives.

Innovative Aspect and Main Advantages

Nowadays the problem of utilized gunpowder in other countries is mainly solved with destruction of gunpowder by burning or explosion, which is connected with irreparable expenses and negative ecological results. Our approach is different from that of others with creation of ecologically safe (zero oxygen balance) industrial explosives based on this gunpowder.

Ballistite jet fuel

Researches implemented at the funding of International Scientific Technical Center (ISTC) in 2004-2007 proved that industrial explosives (compounds) made on the base of utilized colloidal gun powders are distinguished by their detonation properties, are ecologically pure and can be used for destruction of rocks in any conditions, including aggressive medium.

Main advantages include the following:

1. Cheap and ecologically pure industrial explosives are created, which, by their hydrodynamic properties, are equal to the most powerful industrial explosives existing at the current market.
2. Using this technology enables to use repeatedly in industry the obsolete energy carriers, which were to be subjected to destruction.
3. Oxygen balance in the new type explosive compounds is zero, and thanks to it harmful gasses spread in the environment as a result of explosion are brought to minimum.

Areas of Application

- Open pit mining;
- Construction of communication systems;
- Development of construction sites,
- Dismantling of buildings and structures, etc.

Contact Information:

Acting Head of department,
Davit Khomeriki
Tel./Fax: +(995 32) 2328191/+(995 32) 2326887
E-mail: davitkhomeriki@yahoo.com

LABORATORY OF EXPLOSIVES RESEARCH AND BLASTING TECHNOLOGIES

Non-detonating breaking cartridge

Description

Gunpowder and jet fuel on the basis of utilized ammunition with the expired working life have been used as energy carrier.

Initiation is performed by means of ignitor, which is operated from power source. Operation principle is defined by gradual increase of pressure at deflagration of energy carrier in cartridge. In result at pressure of defined value cartridge-case splits and compressed gases shock walls of charging chamber, caused its demolition.

Main advantages/Innovation aspects:

- are **not classified as explosives**;
- **Extremely safe** and Easy- to-use;
- **No measurable noise** vibration and no shock wave damage;
- **Minimal dust** caused, no leaking of any chemical materials;
- **No flying rock** or debris;
- **No special escort** required;
- Shelf life for years.

Areas of application:

- Secondary breaking in mines & quarries;
- Civil construction, demolition;
- Tunneling, box cutting;
- Site clearing;
- Trench digging;
- Farming operations;
- Dimensional stone dressing and sizing;
- Mining, open case and underground operations;
- During Rescue work;
- Rock cutting close to sensitive services like: water supply pipes, gas and fuel lines, electricity supply lines;
- Concrete cutting in reconstruction of buildings.

Contact Information:

Acting Head of department,
Davit Khomeriki
Tel./Fax: +(995 32) 2328191/+(995 32) 2326887
E-mail: davitkhomeriki@yahoo.com

Fabrication of Bimetallic Electrical Contacts by the Method of Explosion Welding

Description

The pipe-line transport systems (of gas pipe-line and oil pipe-line) are mainly in direct contact with the earth. And the earth is ideal environment for corrosion. For anti-corrosion protection cathode stations are used. The main unit of cathode station is anode grounder. It is a graphitized carbon pipe to which by a steel nut is fixed a copper or aluminum electric conductor. The second end of this conductor is connected again by a steel nut to a protected object. Since such a contact is mechanic the contact surface is open for the aggressive environment, they suffer from intensive corrosion and obey to a frequent change that increases the cost of material, demands an additional working hand and other costs for repair work and together with this spoils the protection quality.
The group of scientists from the G.Tsulukidze Mining Institute proposed to change mechanic contacts by bimetallic ones and developed technology for fabrication of Bimetallic Electrical Contacts by the Method of Explosion Welding.

Innovative aspect and Main Advantages

The uniqueness of the approach is in exclusion of such mechanic contacts and in their change with one solid part that will be manufactured by the welding of different kind materials linked together.
The offered production as well as the technology of its fabricationdiffers radically from the existing.
The proposed technology is energy-saving (enables to save 80 % of the electric power), environmentally friendly, cost effective and competitive. The reliability of new technology was tested during joint research activities by group of scientists from G.Tsulukidze Mining Institute and Georgian Gas Corporation.
The bimetallic electrocontacts obtained by Explosion Welding are 2-4 times low in cost price, than obtained by other technologies (plasma, detonative or heating technology). Our electrocontacts are of ideal electroconductivity, a transitive zone and physical and mechanical properties of this zone.

Bimetal samples

Areas of Application

The bimetallic articles are used for protection from corrosion of such pipeline transport systems and such underground communications of urban purpose that are characterized by electrical conductivity, also by electrical contacts in connecting places of the railway transport track economy electrical contacts and of high voltage transfer lines.

Stage of Development

The production in form of bimetallic contacts is ready for distribution and sale in world market. Patent is in an execution stage.

Contact Information:

Head of laboratory
Elguja Chagelishvili, Dr. Phys.-Math. Sc.,
Tel./Fax: +(995 32)
210230/+(99532)325990
E-mail: chageli@yahoo.com

LABORATORY OF EXPLOSION PROTECTION TECHNOLOGIES

System for Protecting People from Accidental and Terrorist Explosions in Underground Structures

The protective system is composed of: i) a wireless device for the detection of explosions and activation of a protective system; ii) a new design of a blast energy absorber with a pyrotechnic activation to ensure discharge of water mist to form a barrier in the path of the shock waves. Results of bench testing and of testing in an underground opening confirmed the envisioned potential of the proposed protective system.

Results of test of the protective system in the underground opening:

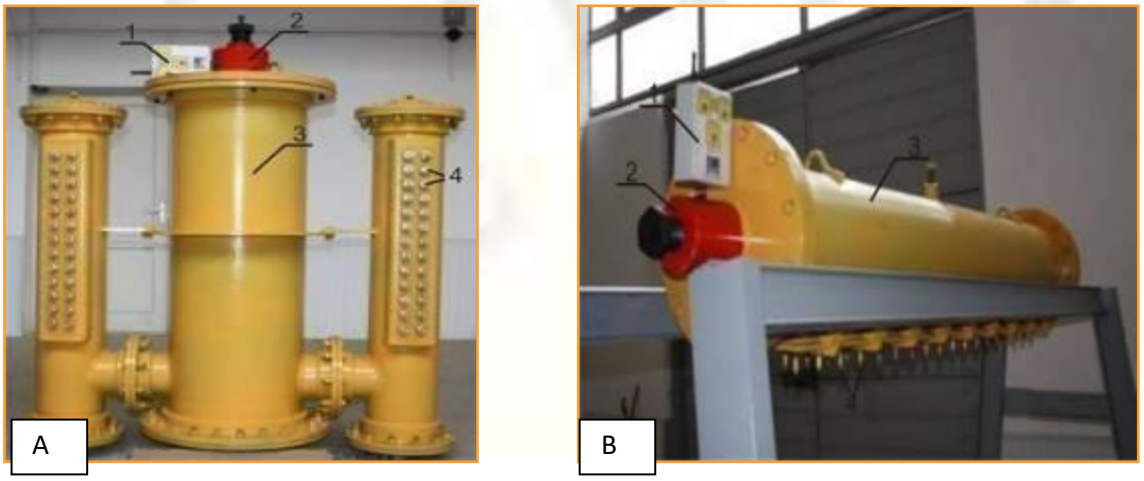
- The protective system at the command of the initiation signal produces tailored dispersing water mist with droplet sizes in the range of 25-400 micron along selected sections of a tunnel;
- The time of absorber activation from the moment of blast: 11 ms;
- Shock wave overpressures are reduced by 2.1-2.3 times.

Areas of application:

- Motorway and railway tunnels;
- Subway tunnels;
- Coal mines under threat of methane explosion;
- Land- or sea-based oil platforms;
- Other petro-chemical plants;
- Long superstructures with limited cross sections that could be loaded by gas or dustexplosions.

Development status: Prototype

Patent landscape: Protected by “know-how”
Video-clip: www.vimeo.com/19792318
The development of the presented protective system was sponsored by NATO’s Public Diplomacy Division in the framework of ”Science for Peace”.



A - Water mist generator for horizontal dispersal; B - Water mist generator for vertical dispersal
1 - absorber control block, 2 - high pressure camera, 3 - water container, 4 - nozzles

Contact information:

Head of laboratory,
Dr. *Edgar Mataradze*
G.Tsulukidze Mining Institute
7, Mindeli Str., Tbilisi 0186, Georgia
Tel./Fax: +(995 32) 325990
E-mail: chikhradze@mining.org.ge
Web-site: www.mining.org.ge

Prof. *Ted Krauthammer*, Ph.D. in Civil Engineering **Center for Infrastructure Protection and Physical Security (CIPPS), University of Florida**
365 Weil Hall Gainesville, FL 32611-6580, USA
Tel./Fax: (352) 273-0691/(352) 273-0186
E-mail: tedk@ufl.edu www.cipps.eng.ufl.edu

DEPARTMENT OF ROCK, BUILDING MATERIAL PROPERTIES AND QUALITY CONTROL

1. **Rocks and soils (grounds) properties research, testing, quality controland assurance:**[1]

   Moisture content, density, water absorption, consistence;

   Strength under pressure, tensile, bending, shear;

   Elasticity module, Poisson ratio, creep;

   Abrasiveness, wear;

   Frost-resistance.

Testing on triaxial compression

Testing on direct shear

Slump testing

2. **Concrete properties research, testing, quality control and assurance:**[1]

   Properties of ingredients;

   Proportioning of concrete ingredients;

   Properties of mixture;

   Mixture casting, placing, consolidation, curing;

   Properties of hardened concrete.

3. **Trainings about rocks, soils (grounds), concrete properties research, testing, quality control and assurance.**[1]

Contact Information:

Dr. Giorgi Baliashvili
Tel.: +(995 32) 2321978; Mob.: +(995 99) 741125
E-mail: baliashvili@mining.org.ge
gbaliash45@yahoo.com

[1] Modern American and European standards and normative documents and methods are used.

A Matrix for Direct Shear of Rock and Concrete Cylindrical Samples under Triaxial Compression Conditions

Description

Under the action of normal external force on the matrix case triaxial compressive stress occurs in sample. Under similar constant stress conditions fixation of bottom part of matrix is performed, and under the action of shear force on the top part of the matrix the shear stress occurs in sample. In case the shear stress exceeds the critical value the sample shears and cleaves in the direction of shear force.

Main advantages/Innovation aspects:

Compared to existing matrices presented one allows to establish the direct shear properties of concrete or rock samples under triaxial compression conditions.

Moreover the matrix enables testing the samples under water-saturated, different fluid-saturated and temperature conditions.

By means of matrix it is available to determine shear properties under constant, normal, shear stress, long-term effect conditions, i.e. to determine parameters of creep deformation and stress relaxation under direct shear conditions.

Areas of application:

Determination of cohesion, internal friction angle, creep and stress of concrete and rock used in tunnel, civil and structural design under conditions of triaxial compression of sample.

Contact Information:

Dr. Giorgi Baliashvili
Tel.: +(995 32) 2321978; Mob.: +(995 99) 741125
E-mail: baliashvili@mining.org.ge
gbaliash45@yahoo.com

ANALYTICAL CHEMISTRY AND MINERAL PROCESSING LABORATORY



Expert and consulting capabilities:

- Consulting in processing and utilization of mineral raw materials area;
- Sampling and preparation;
- Analysis service;
- Technological testing of minerals (ores);
- Environmental service.



Contact Information:

Head of laboratory
Dr. Asmat Shekiladze
Tel./Fax: +(995 **95) 512229/ +(995 32) 2325990**
E-mail: asmatishekiladze@yahoo.com

RESEARCH CENTER OF ENGINEERING DEVELOPMENTS AND DESIGN

The design and engineering group:

1. Setting design schemes of the structures, providing their designing and calculation.
2. The complication and development of structural and architectural elements of civil-industrial engineering and underground constructions.
3. Solving the technical issues during construction of the objects.
4. The implementation of field supervision.
5. Development the projects of construction organization.
6. Drawing up the financial accounting documents by using local-resource method, according to the active normative acts and base prices.
7. Determination of executed work volumes and quantity of required materials.
8. Defects acts compilation.

The engineering system design group:

1. Selection of equipment required for building and its operation monitoring.
2. Projecting energy supply systems for engineering constructions.
3. Projecting water supply and sewage systems for engineering constructions.
4. Projecting heating systems for engineering constructions.
5. Projecting ventilation systems for engineering constructions and execution of their thermophysical and aerodynamic calculation. Designing the ventilation systems with climate-control and without it.

The automated design group:

1. Collecting the initial data necessary for projecting.
2. Implementation and processing design documentation by modern computer systems.
3. Preparing design documentation for submission to Customer.
4. Conducting measuring off operation and compilation of defects acts.

Engineering geological and geodesic group:

1. Making the base geodesic points and determining them
2. Finding up the geodesic points and planning the field topography.

3. Office processing of measuring results and providing its graphical display.
4. Location surveying of engineering constructions and geodesic monitoring.
5. Solving the orientation issues.
6. Creation of survey network and determination of survey points.
7. Underground surveying and providing its graphical display.
8. Specifying tunnel direction and survey control.
9. Location surveying of underground constructions and survey control.
10. Carrying out engineering-geological research.
11. Preparing the engineering-geological conclusions on the basis of research results.

In order to make the high level job we use high precision instruments.

- GPS -System Leica GGS-08plus;
- (Total station) Leica TS-09 plus;

Contact Information:

Head of Center
Dr. Giorgi Javakhishvili
Tel.: +(995 593) 354255 (Mob)
+(995 32) 2329113 (Work)
E-mail: javakhishvili@mining.org.ge

7, E.Mindeli str., Tbilisi 0186, Georgia
Phones: +(995 32) 2329116; +(995 32) 2329074; +(995 32) 2324716
Fax: +(995 32) 2325990
E-mail: tmi@mining.org.ge
www.mining.org.ge