



**THE NEW GENERATION, WHICH WE HAVE CONCLUDED IN R & D STUDIES, IS USED FOR THE PROTECTION OF ARMORED VEHICLES OF THE CERAMIC TYPE, "ERA" TYPE, AND FOR SOUND AND HEAT INSULATION OF ARMORED VEHICLES.**



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## PRE-EXPLANATION

Greeng Innovation Ltd is a small and developing company established to modify clay in ecological isolation and construction materials and to develop ceramic types that do not require cooking. Our company does not have a specific knowledge or infrastructure regarding ammunition, weapon systems, armor and developments in these matters, other than standard resources. However, when we evaluated the results of our R&D studies and made a detailed literature research on the above subjects, the idea that our invention could be a different, practical, quite economical and different method for reinterpreting reactive armor, and a definitive solution for the isolation of armored vehicles arose. Therefore, we would like to underline that this document we have prepared should be evaluated as a "project preliminary study". It is thought that when the solutions we offer and are still hidden in us are transformed into projects and when we have information about the details, other capabilities of our material can be included in the project, and perhaps completely different and very simple solutions can emerge. Therefore, we request that the contradictions, errors and deficiencies that can be seen by the eyes of the subject, but not noticed by us, be ignored for now.

Bülent Gürakın. Greeng Innovation Izolasyon Insaat ve Sanat Ltd Sti Project Manager

## FAILURES AND PROBLEMS IN THE PROTECTION OF ARMORED VEHICLES



**INSUFFICIENCY OF STANDARD ARMOR CAPACITY, ESPECIALLY AGAINST NEWLY DEVELOPED ROCKETS**

A simple rocket projectile can destroy a multi-million dollar armored vehicle along with its personnel.



**NEED ADDITIONAL PROTECTION AS ADDITIONAL ARMOR**

In addition to the existing armor systems of armored vehicles, extra protection systems are required.



**NO SYSTEM CAN PROVIDE 100% FULL PROTECTION**

In the additional protection systems developed, no success has been achieved in providing full protection yet.

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## FAILURES AND PROBLEMS IN THE PROTECTION OF ARMORED VEHICLES



ARMOR DEVELOPED FOR ADDITIONAL SOLUTIONS ARE HIGHLY COST

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Although a complete protection is not provided, these systems are very expensive systems.



THESE SYSTEMS NEED CONTINUOUS DEVELOPMENT

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Rocket launcher technology is constantly being developed in parallel with the developed defense systems.



LACK OF SOUND AND HEAT INSULATION SOLUTIONS APPLIED TO ARMORED VEHICLES

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The existing insulation applications in armored vehicles can be made much more perfect with the material we have developed.



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**AVAILABLE SOLUTIONS AND APPLICATIONS**  
**REAGENT TYPES OF ARMOR USED IN ARMORED VEHICLES**



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### **ERA (Explosive Reactive Armor)**

Explosive reactive armor, namely ERA (Explosive Reactive Armor), is the most widely used armor type among reactive armors. Reactive armors are used primarily in tanks, armored personnel carriers and armored combat vehicles. Explosive reactive armor consists roughly of the explosive sandwiched between two metal plates. If there is any bullet penetration into the metal plate outside of the ERA, the modulator inside it breaks or reduces the effect of the incoming bullet by exploding outward. ERAs also have a disadvantage. If the tank with the ERA on the battlefield is hit, the infantry colliding near it can be damaged.

## **SLERA (Self-Limiting Explosive Reactive Armour)**

Self-limiting explosive reactive armor (SLERA) is a modified explosive structure shaped with the base of the ERA system.

SLERA (self-limiting explosive reactive armor) uses explosives with a lower mass than can be considered passive armor.

Thanks to the explosive in its structure,

SLERA ensures that the explosive penetrating into it is spread in a controlled manner.

Although SLERA causes lower performance compared to ERA, it also reduces the effects on vehicle structure.

However, SLERA is cheaper and easier to produce.





### **NERA (Non-Energetic Reactive Armor)**

Non-energy reactive armor, namely NERA, has a similar sandwich structure like ERA's, but does not contain explosives. It is usually formed by placing materials such as plastic and aramid between blocks such as boron carbide, alumina, titanium carbide, silicon carbide, which are ceramic-metal formations formed by sintering with HIP (Hot Isostatic Pressing). It is an armor that has a much longer life compared to ERAs, is expensive to manufacture and has high maintenance costs. ERAs are known as disposable reactive armors. NERAs are long-lasting. It can withstand multiple impacts. It needs to be replaced every 5 years and maintenance is expensive



### **NxRA (Non-Explosive Reactive Armor)**

Non-explosive reactive armors, in short, NxRAs, are similar to NERA armors. There is only one structural difference. Polymer is used instead of plastic. As in SLERAs, NxRAs, which are also used by Israel, have more effective protection against high explosive anti-tank (HEAT) ammunition than

NERAs. It protects the tanks by reacting to the explosion that occurs after being hit, just like the

SLERA's, in a way that affects a much larger surface instead of a very small point. In order to increase the protection, Israel chose to use NxRA

at the risk of damage to the armor, so it could protect its tanks better against anti-tank ammunition, but it had a lot of HEAT protection.

Because of its orientation, its tanks had to be protected much less against tanks such as Leopard 2A7, M1A2 Abrams, ALTAY against armor-piercing sabot ammunition.





## NO SOLUTION

Current solutions cannot fully solve the problem

Today, it is seen that even reactive armored vehicle protection systems, which are considered as the most advanced armor system, cannot provide complete protection against the developed technologies and electronic and electromagnetic methods are used for a definitive solution.

## THE SOLUTION MAYBE MUCH SIMPLE THAN THOUGHT

The result is that a new perspective is needed on this issue. The solution may be hidden in very simple applications. However, this requires a skilled and economical material.



Very hard, hybrid available shell



Very light and strong porous layer into which new solutions can be hidden



A new perspective  
The perfect combination

## **RELATIONSHIP OF THE MATERIAL WE DEVELOPED WITH REACTIVE ARMOR TECHNOLOGY**

### **TECHNOLOGY USED IN EXISTING SYSTEMS**

As it is known, especially the first three armor protection systems are used to hide explosives of various strengths (RPG-7, RPG-29, RPG-27 etc.) inside special ceramic plates or ceramic plates used hybrid with metal, and the rocket will be ineffective as a result of the counter-explosion. It is based on the principle of bringing. The production of ceramic plates used for this purpose requires production systems in which high temperature furnaces and high pressure presses are used together. Ceramics carrying the explosive weigh more than 2000kg / M<sup>3</sup> (specific gravity 2>) and overload the armored vehicle or tank in intensive use.

Especially in combat conditions, the fuel consumption of each kilogram weight and the armored vehicle or Considering that it reduces the speed and mobility of the tank, it is a fact that this type of extra protection includes some disadvantages as well as the benefits it provides. The lack of an alternative solution to this issue has made it necessary to use these methods as the best solution.

## PROPERTIES OF OUR MATERIAL

Our company is an R&D company established to develop specific ceramic types that do not require baking, based on their experience in the ceramic industry. Our project, which we started in 2015 and turned into an official project in 2018, was officially finalized successfully on 21 12 2020.

According to the results we have obtained;

- 1 - Our material is Clay + Natural Pozzolan origin. As a result of our R&D work, it was brought to TRL 7 level.
- 2 - It has a mineral structure, it does not contain any synthetic, flammable or harmful components.
- 3 - It is extremely economical from its raw material to processing processes.
- 4 - It does not need to be fired or heat treated in order to show its ceramic properties.
- 5 - It is in liquid form. Its application is extremely simple. It is mixed and poured into molds. It hardens spontaneously under atmospheric conditions.
- 6 - Since it is not cooked, it carries all kinds of assigned materials while preserving their properties.
- 7 - It forms a whole with hard materials such as Silicon Carbide and Quartz, and it fully reflects the properties of these materials in their physical structure.

The features listed above are the general properties of our material.

As for the main feature that makes our material a "special material":

MATERIAL WE DEVELOPED Clay + Natural Pusolan  
IT IS ORIGINAL AND OUR MATERIAL HAS TWO DIFFERENT FORMS

"All the materials we have developed are different forms of these two materials"

**GreCer**

**Nonporous Clay + Natural Pozzolan**

100% ecological, Clay + Natural pozzolana origin, non-porous, compressive strength adjustable from 20 MPa to 60 MPa (it is possible to increase this figure in special forms), showing ceramic properties, resistant to all kinds of natural conditions, resistant to water, A1 class fireproof, environmentally friendly, 1600 - 2500 kg / M3 density industrial material.

**GrePor**

**Porous Clay + Natural Pozzolan**

100% ecological, porous, resistant to all kinds of natural conditions, A1 class fireproof, Clay + Natural pozzolana origin, 60 - 400 kg / M3 density, 100 kPa - 7 MPa pressure resistance (it is possible to increase the values in special forms) Mineral insulation material with an insulation coefficient of 0.025 - 0.10 W / mK.

**THE MAIN FEATURE THAT MAKES OUR MATERIAL  
"SPECIAL AND UNRIVALED IN ITS FIELD"**

Since both materials (GreCer and GrePor) have the same origins, they can be applied in layers in the same process. In other words, an extremely hard surface with the desired thickness and extremely light under this surface, with excellent heat and sound insulation ability, without deteriorating the structure of everything desired (no cooking or heat is required for hardening)

A single layer product with excellent properties can be obtained by applying a second layer of desired thickness, which can be concealed.

Since both materials come from the same origin, they are molecularly and chemically linked and show the properties of a single layer. They do not tend to be separated from each other by time, climatic conditions, mechanical and chemical effects and have an infinite life.



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## HOW OUR MATERIAL CAN BE USED IN REACTIVE ARMOR TECHNOLOGY ..?

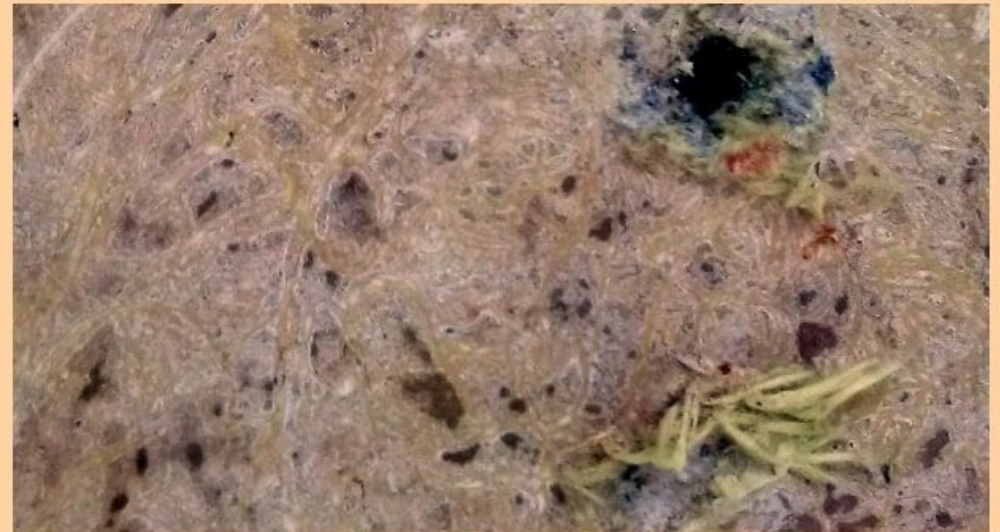
The two-layer, i.e., front surface of which is extremely hard and armored as described above + a porous, light, yet strong, second layer that can store all kinds of weak explosives, chemical substance capsules, assemblies, etc., and is not affected by external influences, just behind it = For armored vehicles an extremely economical and easy to produce protective secondary hood, or shell ...

We have seen in the tests we conducted in 2018-2019 at Muğla Provincial Gendarmerie Command that the 2-2.5 cm thick form obtained by using our material together with composite materials such as Aramid and Kevlar can stop G3 bullets. However, the characteristic difficulties of the ballistics industry caused us to halt this work and shift our project to other areas in order to continue our commercial life. In the evaluation we made upon the successful conclusion of our project, we realized that the capacity and capabilities of our material were much more advanced than the first studies we did in the field of ballistics. That's why we decided to write this preliminary project with the results we obtained.



## CAN A DIFFERENT TECHNOLOGY BE DEVELOPED WITH OUR MATERIAL FROM REACTIVE ARMOR TECHNOLOGY ..?

Undoubtedly yes ... With the new possibilities brought by the material we have developed (showing ceramic properties without the need for cooking and using the hard shell + porous layer in the same process = very light, very durable, an economical secondary layer where the desired features can be loaded, the bonnet) rocket launchers could be no longer a threat to armored vehicles. We have some ideas and preliminary work to bring this argument to life.

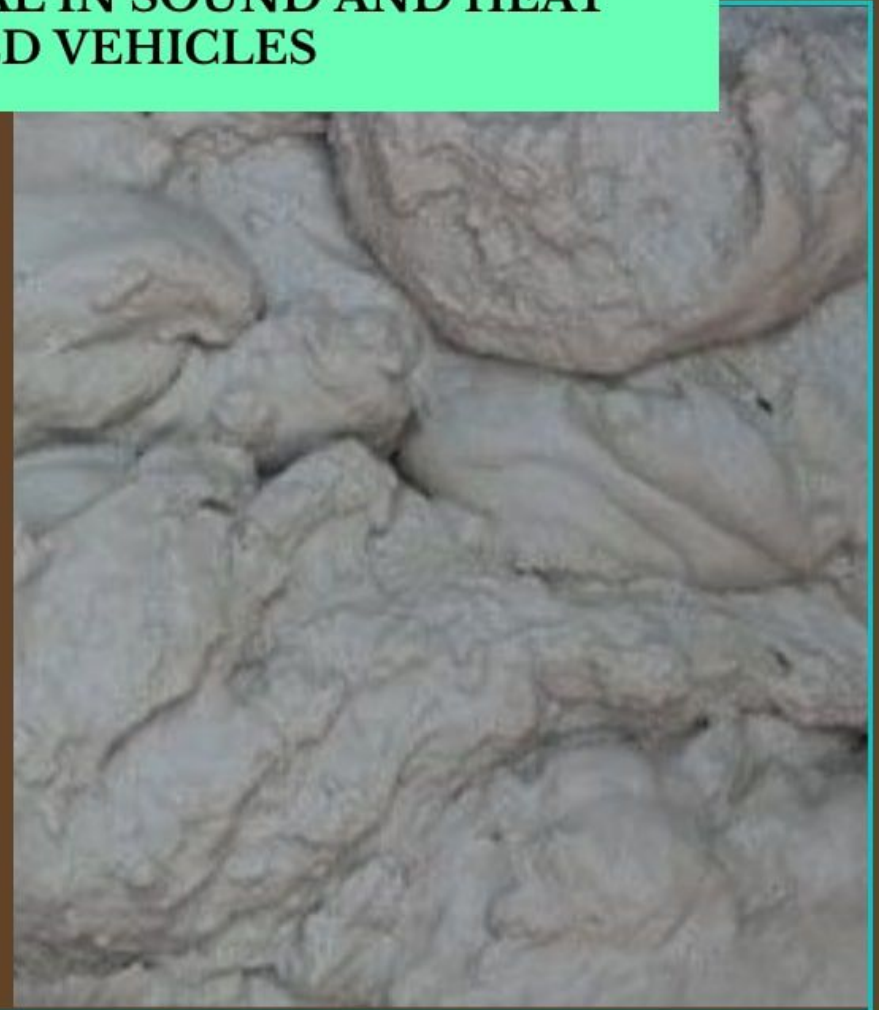


Our test plate that stops the 2 cm thick Tvaron supported G3 bullet

## USING FOAM FORM OF OUR MATERIAL IN SOUND AND HEAT INSULATION OF ARMORED VEHICLES

Although the use of our material in reactive armor technology requires a project, the use of sound and heat insulation of armored vehicles does not require a project. Because in the R & D project we have finalized, the isolation issue has been successfully completed and is usable.

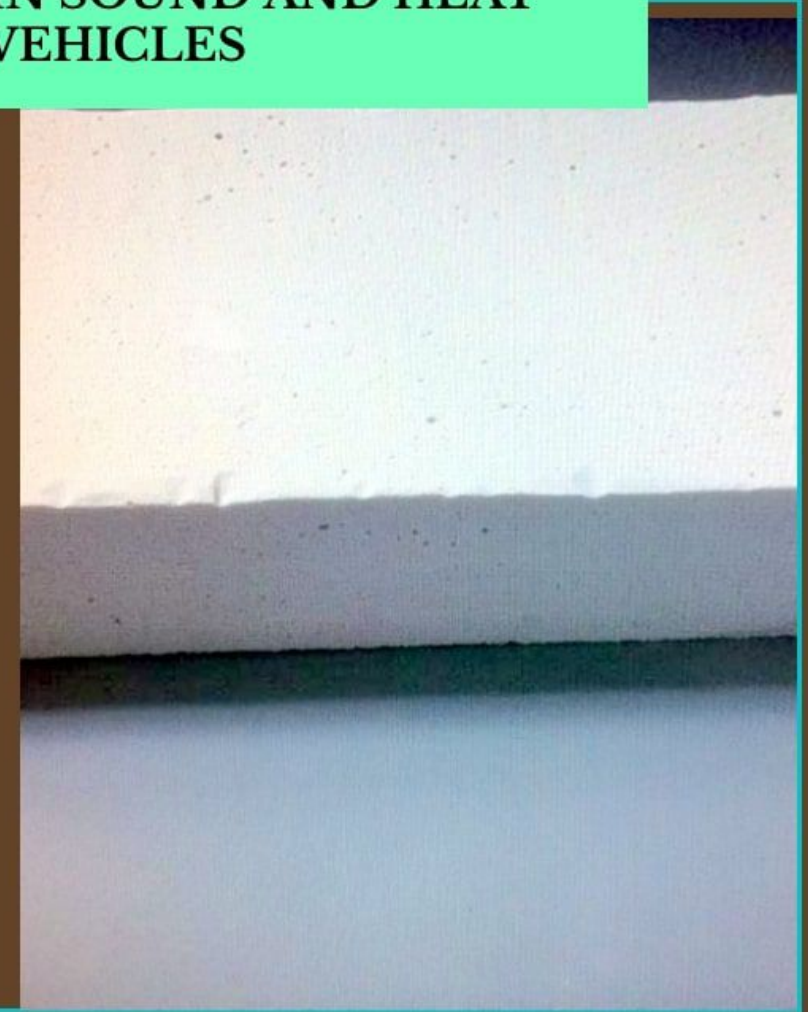
The mineral foam form of our material is an extremely economical and permanent solution instead of insulating materials that are not permanent in the long term, harmful to health, need to be renewed and have insufficient physical properties such as expensive ceramic insulation plates, glass wool, rock wool, which are currently used in the insulation of armored vehicles.



## USING FOAM FORM OF OUR MATERIAL IN SOUND AND HEAT INSULATION OF ARMORED VEHICLES

Another important feature that makes our material unrivaled is that it is extremely simple to use the material in a mobile manner and it can be used by mixing the components that make up the material and injecting it into the spaces in place. The material swells like polyurethane foam where it is applied and fills all inaccessible spaces without leaving any gaps. In this way, it provides ideal heat and sound insulation that is resistant to high temperature, non-flammable and does not produce toxic gases.

Our material is an unrivaled insulation material in the world with its 80-120 KG / M<sup>3</sup> density and 0.035 W / mK - 0.040 W / mK and 135- 190 kPascal compressive strength values.





The materials and products we have developed are in TRL 7 stage. As we mentioned in the beginning, this presentation is a preliminary project draft and should be rigorously reworked with a professional team including experts. We believe that new and surprising solutions can be produced with our know-how and new solution suggestions.

For this reason, we are looking for companies that are official, semi-official and with strong infrastructure that are experts in their fields and open to innovations and extraordinary solutions to support and reshape this project.

Geniř bilgi iin [www.greenginnovation.com](http://www.greenginnovation.com) sitesimizi ziyaret edebilirsiniz. Ya da [blntgrkn@gmail.com](mailto:blntgrkn@gmail.com) adresinden bizim ile iletiřime geebilirsiniz.

