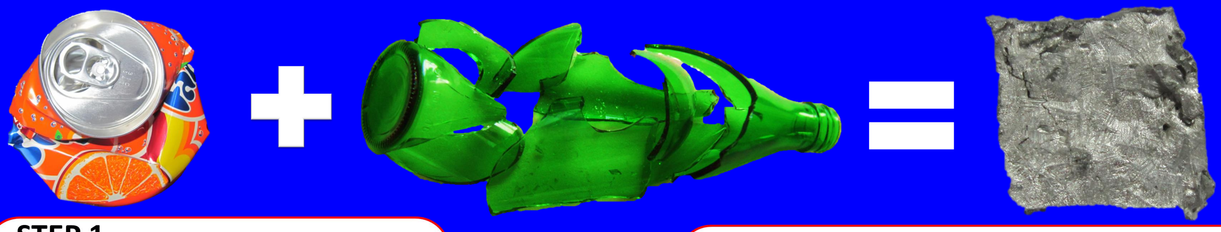


STEP 1.

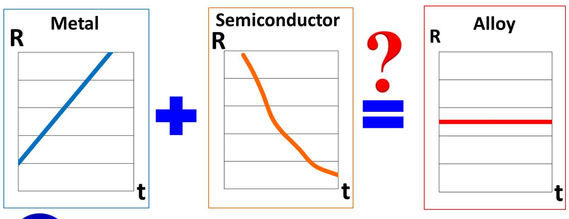
Table 1. Properties of thermostable materials.

Properties	Manganin	Constantan
Density, kg/m^3	8400	8800
Specific heat, J/(kg*K)	418	415
Resistivity, Ω*m*10^{-8}	45	48
Temperature coefficient of resistance, K^{-1}	0.00002	0.00003
Minimum price per 1 kg	28 $	22 $

These materials are **pretty expensive, they have low specific heat and high density**.

How can a cheap, lightweight, thermostable material with high specific heat be produced?

STEP 2.



If metal is melted with semiconductor, could a thermostable alloy be produced?

What metal and semiconductor to choose for the production of a new material?

STEP 3.

Table 2. Properties of aluminum.

Properties	Aluminum
Density, kg/m^3	2700
Specific heat, J/(kg*K)	930
Resistivity, Ω*m*10^{-8}	2.8
Temperature coefficient of resistance, K^{-1}	0.004
Minimum price per 1 kg	0.7 $

Al

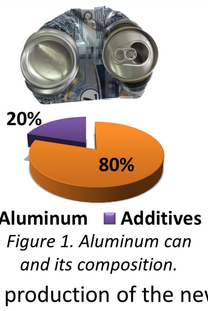


Figure 1. Aluminum can and its composition.

SiO_2

- its conductivity depends on the impurities;
- it becomes a semiconductor when melted with Al;
- cullet contains it.

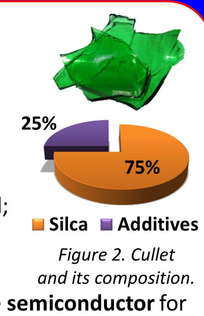


Figure 2. Cullet and its composition.

Aluminum is the suitable metal for the production of the new material: its price is low, it has high specific heat and low density.

Silicon dioxide is a suitable semiconductor for the production of the new material.

Aluminum and silicon dioxide alloy is silumin.
Are the required characteristics to be found in silumin?

STEP 4.

Figure 3. Silumin.

- is based on aluminum and quartz sand alloying (4-22% SiO_2);
- its cost is about 3 $ per 1 kg;
- its electrical properties haven't been deeply studied by scientists yet.

So I tried to study them...

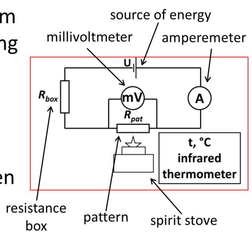


Figure 4. Installation scheme.

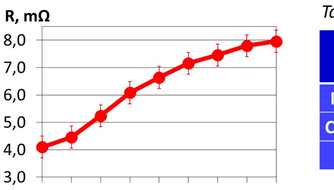


Figure 5. Graph of silumin resistance dependence on temperature

Table 3. Properties of aluminum.

	Temperature coefficient of resistance, K^{-1}
Manganin	0.00002
Constantan	0.00003
Silumin	0.017

Silumin is **NOT a thermostable material**.

What is the optimal mass ratio of glass and aluminum for thermostable material?

STEP 5.

Stages of the production of new material with different mass ratio of glass and aluminum.

Figure 6. Production of new material in school lab.

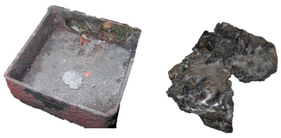


Figure 7. Failed patterns.

12.5% of glass

25% of glass

37.5% of glass

Figure 8. Produced alloys.

Figure 9. Installation scheme.

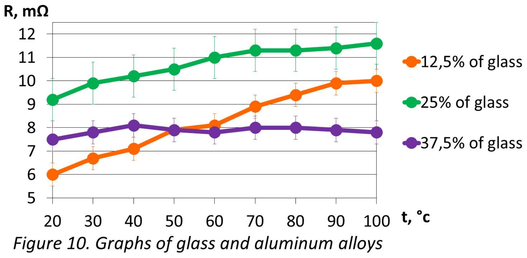


Figure 10. Graphs of glass and aluminum alloys resistance dependence on temperature.

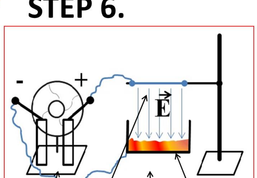
Resistance dependence of glass and aluminum alloy with 37.5% of glass on temperature is **insignificant**.

I named this material

AluGlass 1

How to increase the thermal stability of AluGlass?

STEP 6.



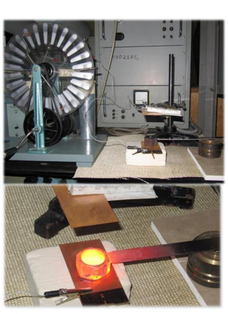


Figure 11. Crystallization of AluGlass in conditions of uniform electric field.

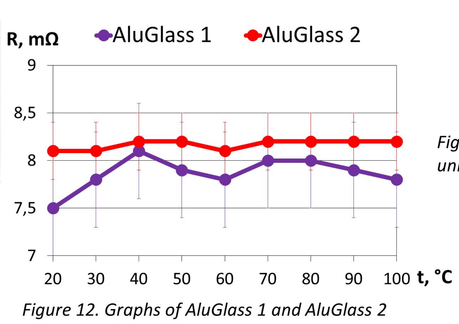


Figure 12. Graphs of AluGlass 1 and AluGlass 2 resistance dependence on temperature

AluGlass 2

Figure 13. AluGlass 2 was crystallized in uniform electric field.

Crystallization in conditions of uniform electric field increased thermal stability of AluGlass.