New approach to the creation of LENR - reactors

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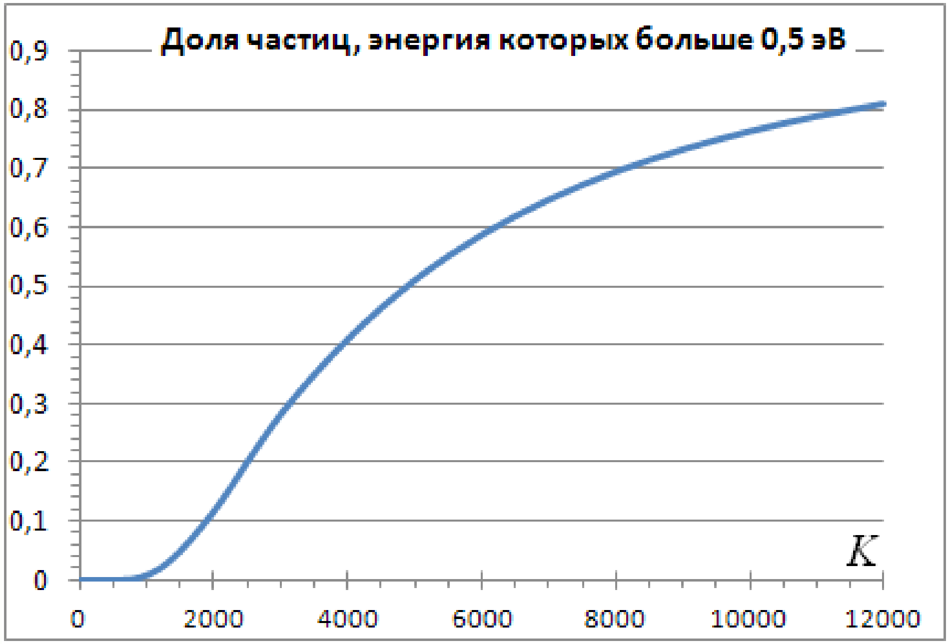
The hypothesis about the participation of neutrinos in nuclear transformations

If it is true that the mass of electron neutrinos and antineutrinos is <0.28 eV, they can be formed as a result of inelastic collisions of matter particles (electrons, ions, neutral atoms) during their thermal motion. The energy of colliding particles should be on the order of 0.5 eV and higher



Especially often electrons collide with atoms in metals: about 10^{36} collisions per second occur in 1 cm^3. Such a high frequency of collisions leads to the appearance of a huge number of neutrinos and antineutrinos, even with a very low probability of their formation. The resulting neutrinos and antineutrinos can interact with the nuclei of the surrounding matter.

Important: the de Broglie wavelength of the resulting particles is of the order of 1 micron. This means that the interaction region encompasses a huge number of atoms, which makes possible transformations covering many atoms and nuclei, as a result of which even unlikely processes become significant.

Nuclear transformations involving neutrinos, electrons and two nuclei

Rearrangement of nucleons with electron absorption:

$$\tilde{\nu} + (A1, Z1) + (A2, Z2) + e^- \rightarrow (A3, Z3) + (A4, Z4) + Q$$

$$A3 + A4 = A1 + A2, \quad Z3 + Z4 = Z1 + Z2 - 1$$

Rearrangement of nucleons with the release of electrons:

$$\nu + (A1, Z1) + (A2, Z2) \rightarrow (A3, Z3) + (A4, Z4) + e^- + Q$$

$$A3 + A4 = A1 + A2, \quad Z3 + Z4 = Z1 + Z2 + 1$$

A computer program has discovered about 700,000 variants of such nuclear transformations.

For example, in corundum (Al_2O_3) and in quartz (SiO_2), after long-term operation in a nickel-hydrogen reactor, a lot of calcium was found. Perhaps this is due to the course of reactions

$$\tilde{\nu} + {}^{27}Al + {}^{16}O + e^- \rightarrow {}^{43}Ca + 16{,}460 \text{ МэВ.}$$

$$\tilde{\nu} + {}^{28}Si + {}^{16}O + e^- \rightarrow {}^{43}Ca + {}^{1}H + 4{,}878 \text{ МэВ.}$$

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LENR как проявление слабых ядерных взаимодействий

А.Г. Пархомов

***Аннотация*—Малая масса нейтрино (антинейтрино) делает возможным их интенсивную генерацию в результате соударений частиц вещества при тепловом движении. Возникающие нейтрино (антинейтрино) имеют энергию порядка 0,1 эВ. При такой энергии длина волны де-Бройля около 5 мкм. Это означает, что в ядерные слабые взаимодействия вовлекается огромное число атомов, что делает эффекты от ядерных трансформаций с участием нейтрино (антинейтрино) реально наблюдаемыми. Рассмотрение термической генерации нейтрино как основы ядерных трансформаций в процессе LENR позволяет объяснить целый ряд особенностей этого явления.**

I. Введение

Обширный класс явлений, которые называют «низкоэнергетическими ядерными реакциями» (НЭЯР, LENR) или «холодными трансмутациями ядер» (ХТЯ) или устаревшим «холодным синтезом», на самом деле не являются ни низкоэнергетическими (энергии выделяется очень много), ни холодными (можно ли назвать процессы, в которых признаки LENR обнаружены при комнатной температуре (электролиз [7], биология [8], [9]), являются исключением из этого правила. Но на самом деле, для актов энергообмена как в электрохимии, так и в процессах клеточного метаболизма характерны именно энергии порядка 1 эВ.

Второй особенностью является то, что процессы LENR происходят в достаточно плотной среде (твердое, жидкое состояние или плотная плазма).

Третьей особенностью является большое разнообразие нуклидов, возникающих в процессе LENR.

Четвертой особенностью является отсутствие (или очень малая интенсивность) жестких ядерных излучений (нейтроны, гамма кванты), которое, казалось бы, неизбежно должно возникать при ядерных трансформациях.

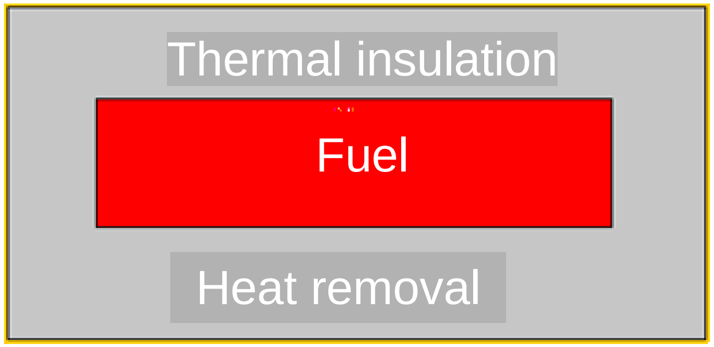
Эти особенности могут указать путь поиска физического механизма LENR. Надо искать механизм, проявляющийся при энергиях больше 0,1 эВ, дающий большое разнообразие нуклидов, а изменения на ядерном

The hypothesis of the participation of neutrinos in nuclear transformations makes it possible to explain many features of LENR:

- **The need to heat up to a temperature of about 1000 ° C and above (the message to the particles of a substance is not less than tenths of an eV)**
- **The need for a sufficiently dense environment**
- **The emergence of a wide variety of nuclides not only in the "fuel", but also in the surrounding matter**
- **Absence or very low intensity of hard nuclear radiation**
- **In nuclear transformations involving neutrinos, there is no problem of the "Coulomb barrier"**

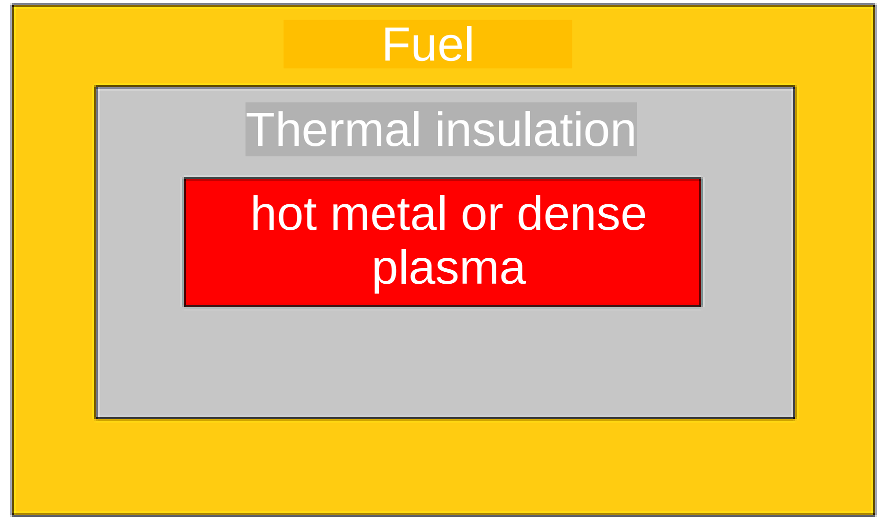
The neutrino-antineutrino source (hot metal or dense plasma) can be separated from the "fuel" - the substance where nuclear transformations take place. This opens up the possibility of consciously designing highly efficient LENR reactors.

Traditional scheme



The zone with a high temperature (hydrogenated metal, plasma) is surrounded by a layer of a substance that performs contradictory tasks of thermal insulation and heat removal. This does not allow the creation of powerful reactors with a high ratio of released and consumed energy.

Reactor of a new type



The source of the agent causing nuclear transmutation (hot metal or dense plasma) is located inside the thermal insulation. This allows high temperatures to be achieved with low energy consumption.

Fuel (a substance where processes with high heat release take place) is located at the periphery, which makes it possible to efficiently remove the released heat.

The Mizuno reactor is an example of a new type of reactor

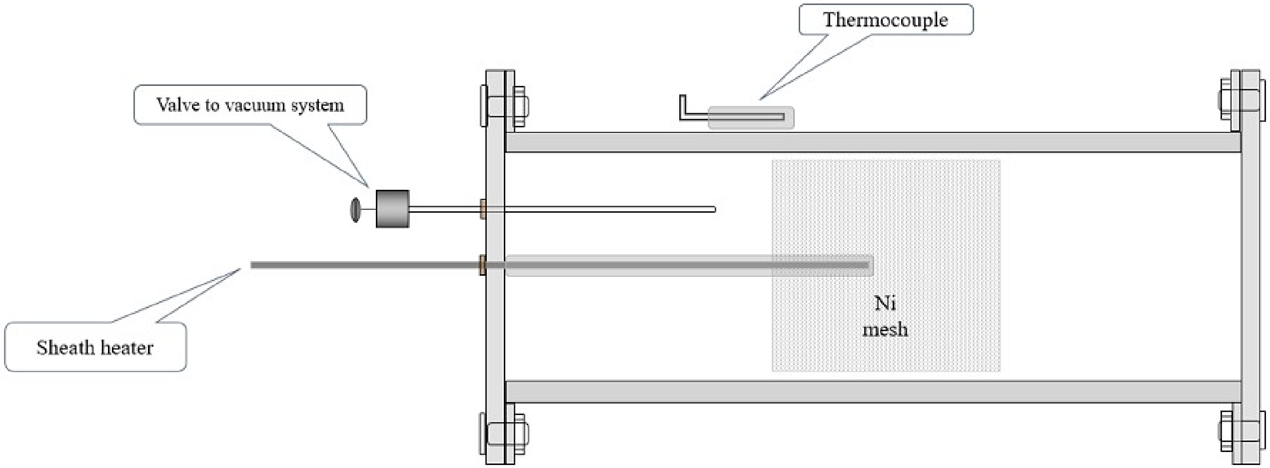


Figure 13. Schematic of R20 reactor.

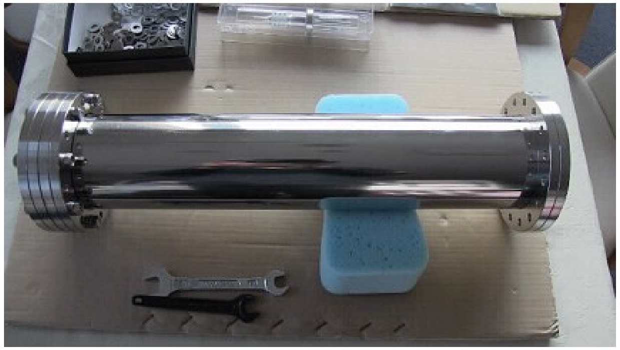


Figure 14. R20 stainless steel reactor vessel.

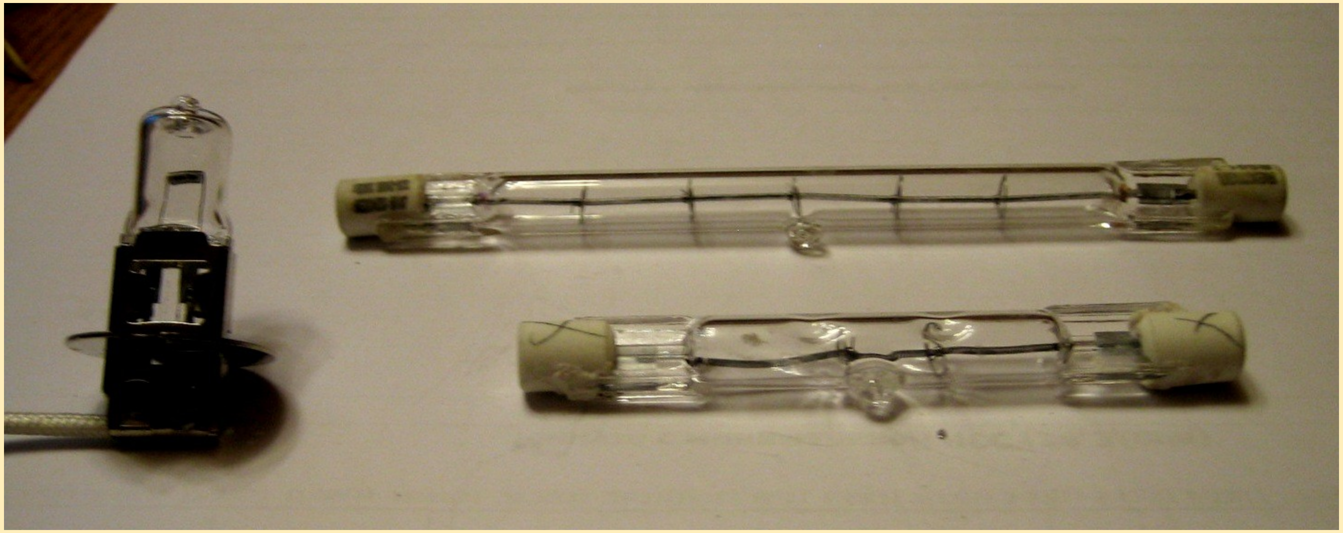
with 300 W it produces ~2 to 3 kW.

Tadahiko Mizuno

Incandescent lamps used in experiments

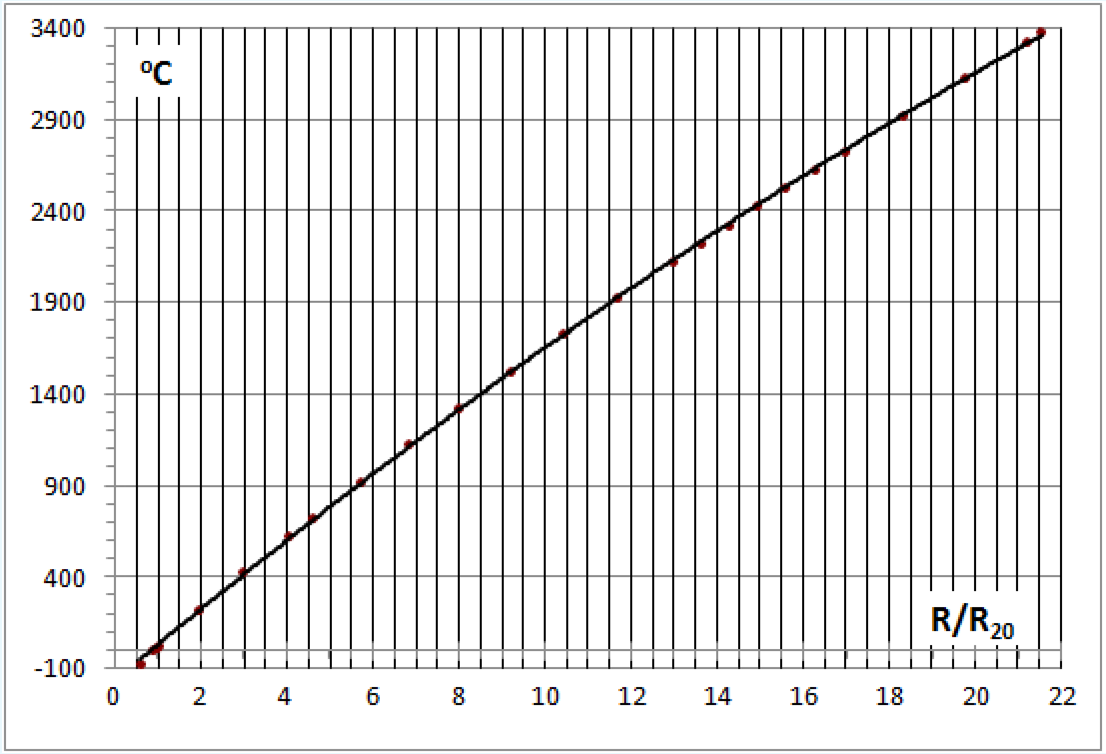
Simple 40 W lamp

Halogen lamp 70 W



Automotive halogen lamp 100 W and halogen lamps 300 and 150 W

Determination of the temperature of the tungsten filament

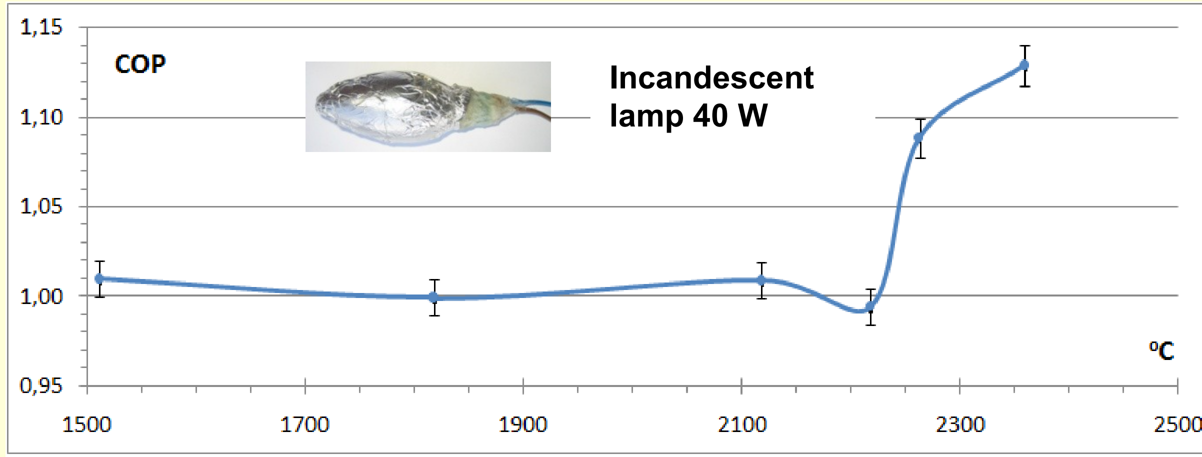


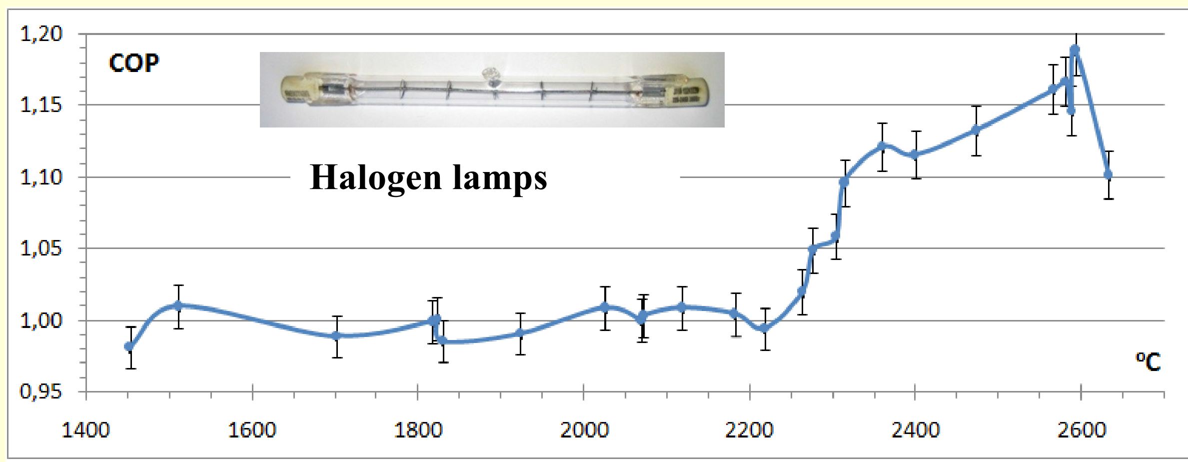
Temperature of a tungsten wire depending on the ratio of its resistance to resistance at room temperature

The temperature of a tungsten filament in incandescent lamps can be determined by measuring its resistance at room temperature R_{20}, as well as voltage U and current I in the operating mode $R = U/I$; $t = f(R/R_{20})$.

Using the same data, you can determine the power consumed by the lamp P = U * I.

Measurement of the power of heat release by the rate of temperature rise in water





Excessive heat generation occurs at temperatures above 2200 °C.

Possible nuclear transformations in reactors with incandescent lamps in water

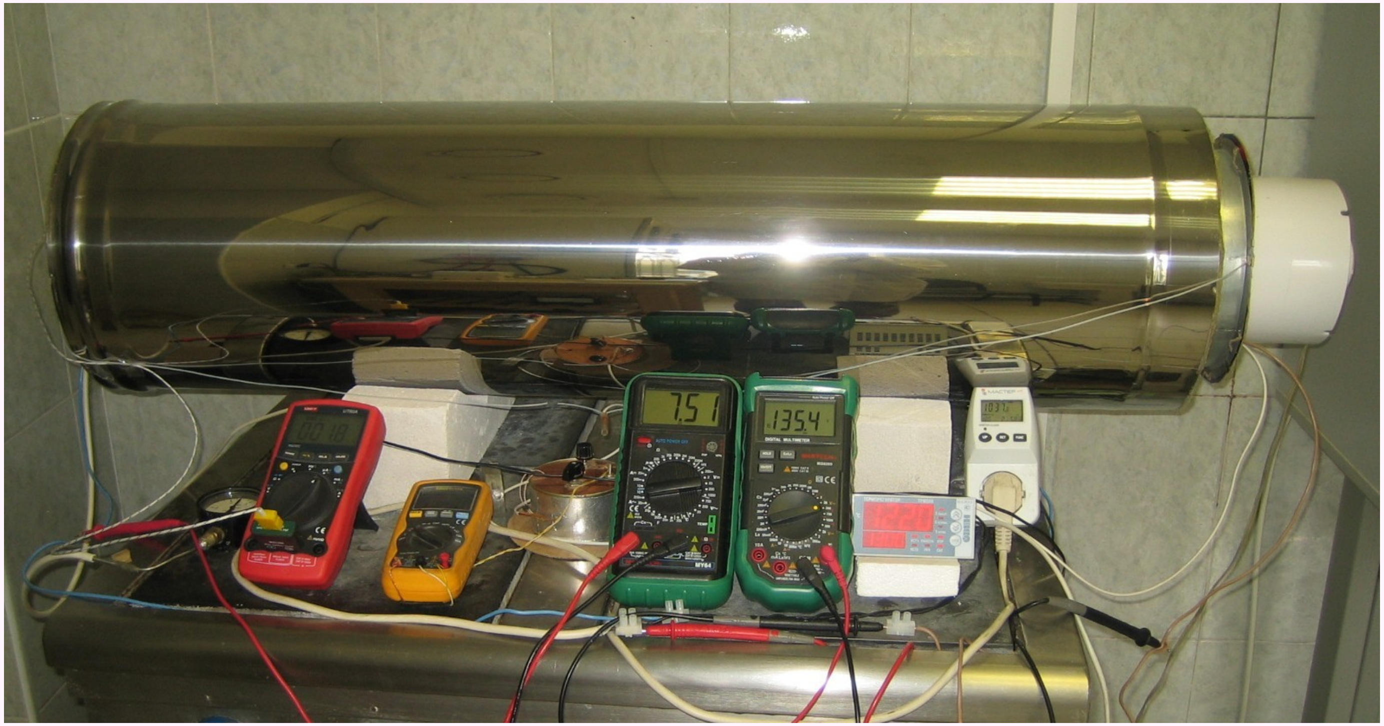
$$2\nu\sim + H_2O + 2e^- \text{----->} {}^{18}O_8 + 11{,}646\ \text{MeV}$$

$$2\nu\sim + 2H_2O + 2e^- \text{----->} {}^{36}Ar_{18} + 50{,}933\ \text{MeV}$$

$$4\nu\sim + 3H_2O + 4e^- \text{----->} {}^{54}Fe_{26} + 87{,}810\ \text{MeV}$$

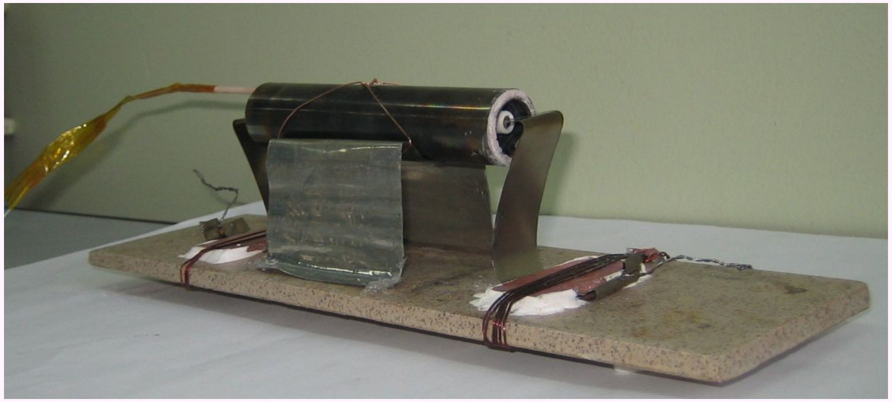
$$\nu^{\sim} + {}^{28}Si + {}^{16}O + e^- \rightarrow {}^{43}Ca + {}^{1}H + 4{,}878\ \text{MeV}.$$

Flow-through air calorimeter

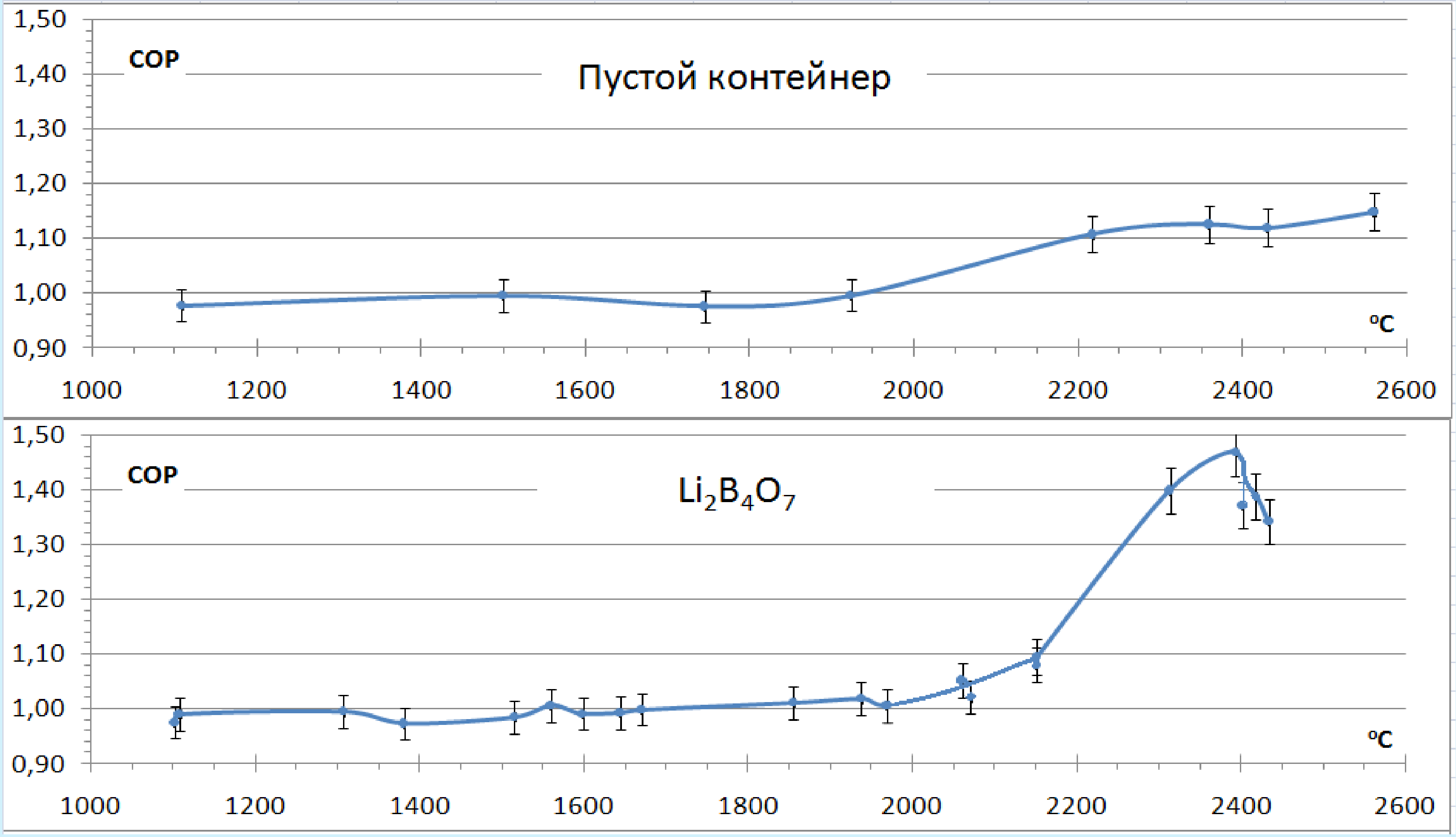


The heat release power is determined by the increase in the temperature of the air washing the object under study

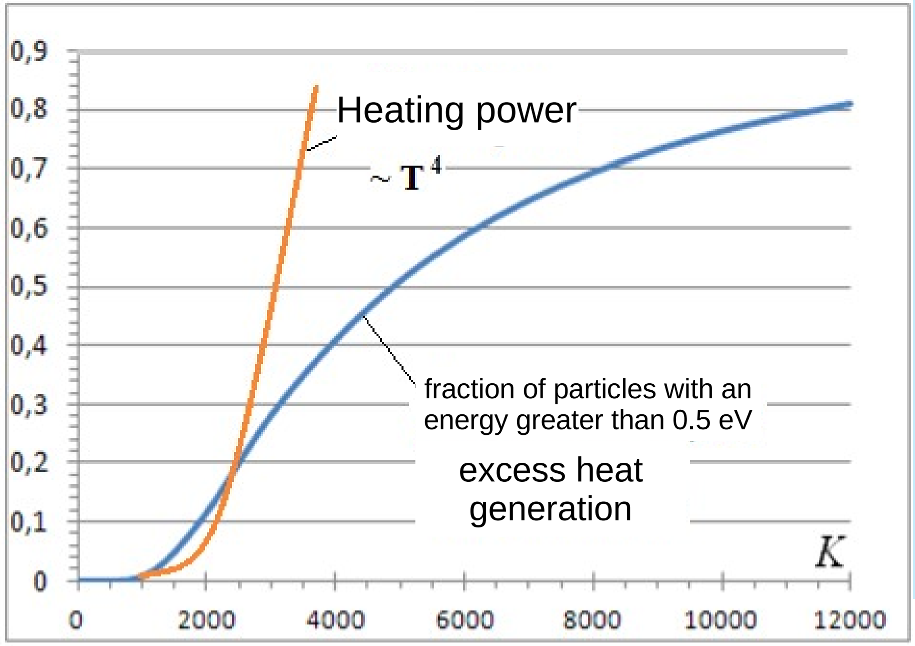
The halogen incandescent lamp is located inside a cylindrical stainless steel container that can be filled with various substances



Thermal coefficient in a flow-through air calorimeter depending on the temperature of the filament in a halogen lamp



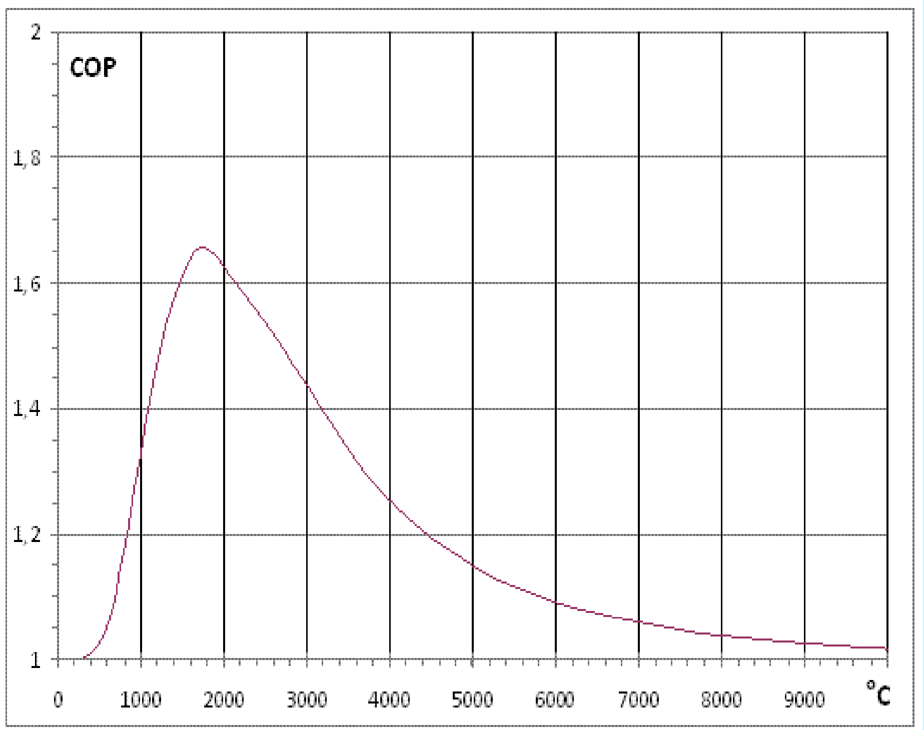
Excessive heat generation at temperatures above 2200 °C is observed even in the case of an empty container, but a container filled with lithium tetraborate has a much stronger effect (up to 50%)



Heating power and excess heat generation depending on temperature

At high temperatures, the power required for heating grows much faster than excess heat release.

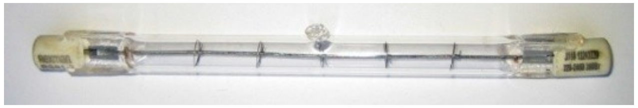
Therefore, upon reaching a certain temperature, the thermal coefficient begins to decrease.



Measurement of the power of heat release by the rate of water boiling away

Specific heat of vaporization of water at 100°C 2260 J / g

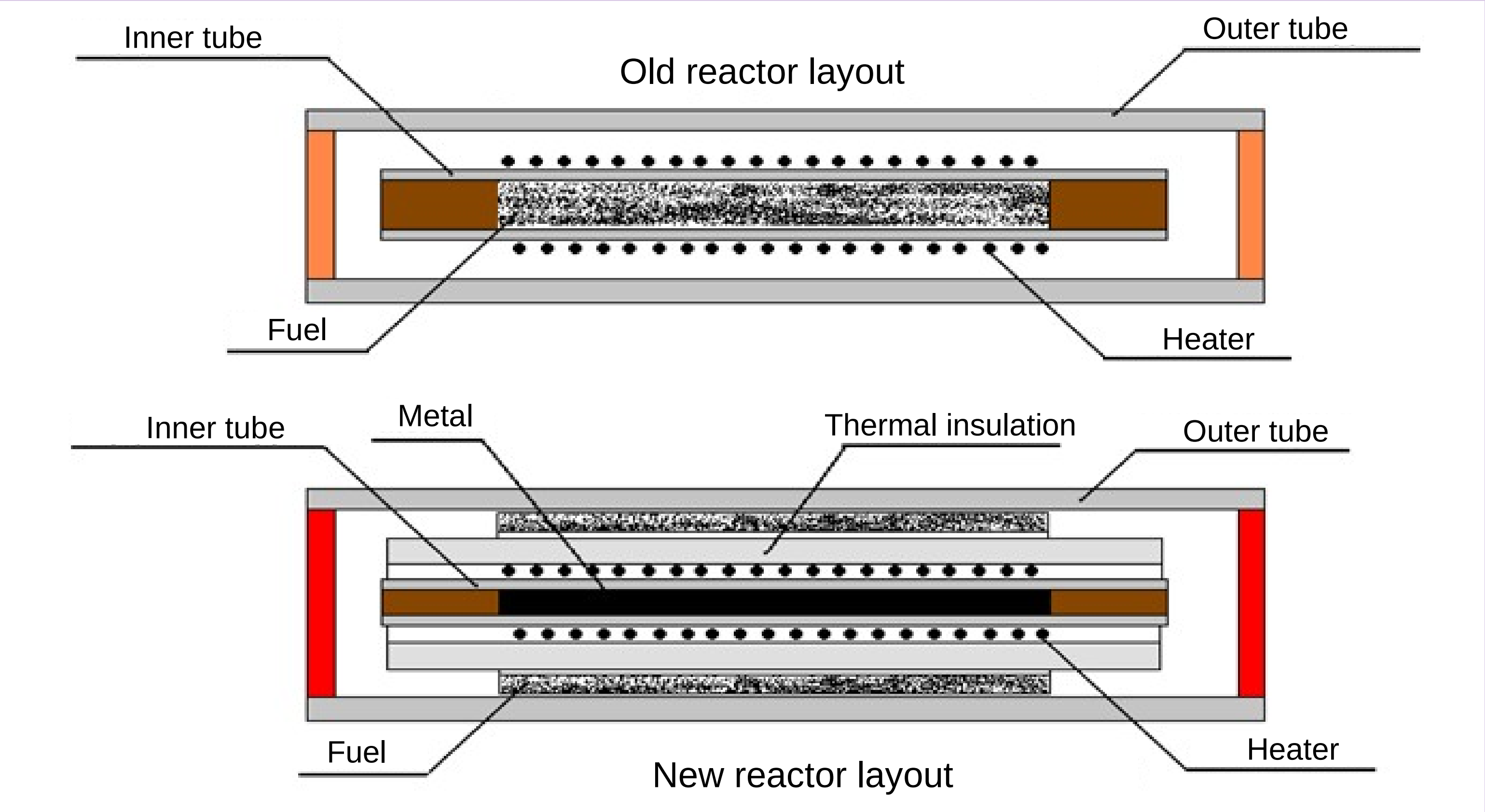
A halogen incandescent lamp with a rated power of 300 or 150 W is immersed in a glass vessel with clean water or a solution. The rate of weight loss is measured.



In the process of work, the elemental composition changes

	Из электро-сети	Темпера-тура нити накала	Скорость испарения	Расход тепла			Тепловой коэф-фициент
				На испарение	На тепло-обмен	Сумма	
	Вт	°C	г/с	Вт	Вт	Вт	COP
Вода	222	2039	0,0728	165	55	220	0,98
Вода	476	2416	0,2026	458	55	513	1,08
7% раствор $Li_2B_4O_7$	528	2598	0,2222	502	60	562	1,07
3% раствор $(NH_4)_2WO_4$	284	2210	0,1050	237	97	334	1,18
1,5% $NaBiO_3$	274	2176	0,0889	201	97	298	1,09

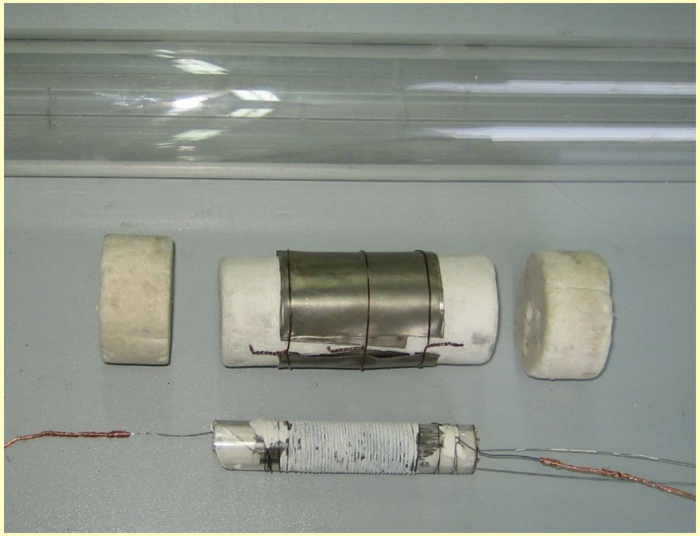
Redesign of nickel-hydrogen reactors



The metal core is located inside the thermal insulation, which allows it to be heated with little energy.

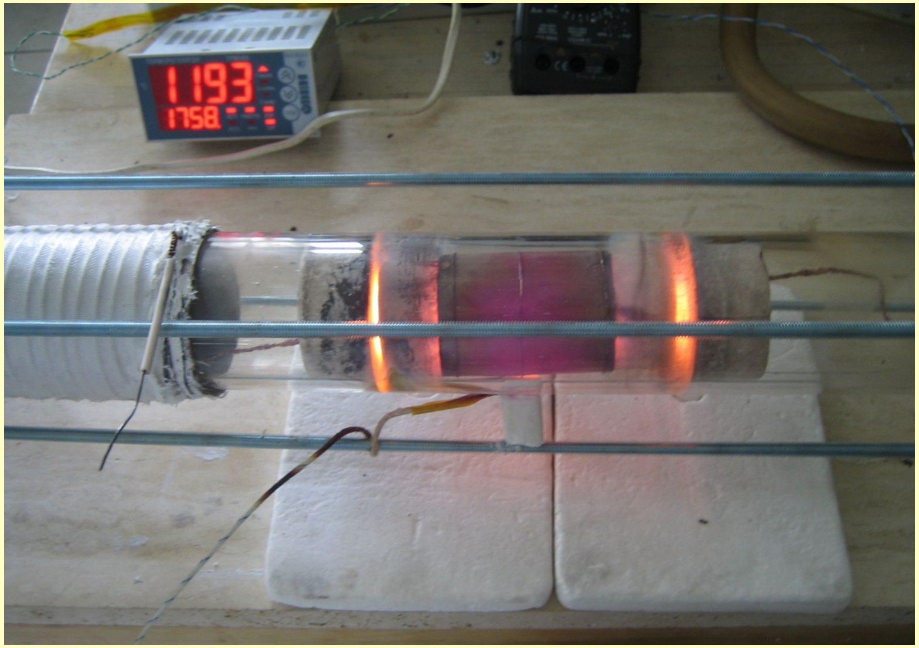
The fuel is located on the periphery, which allows intensive heat removal.

Reactor C3

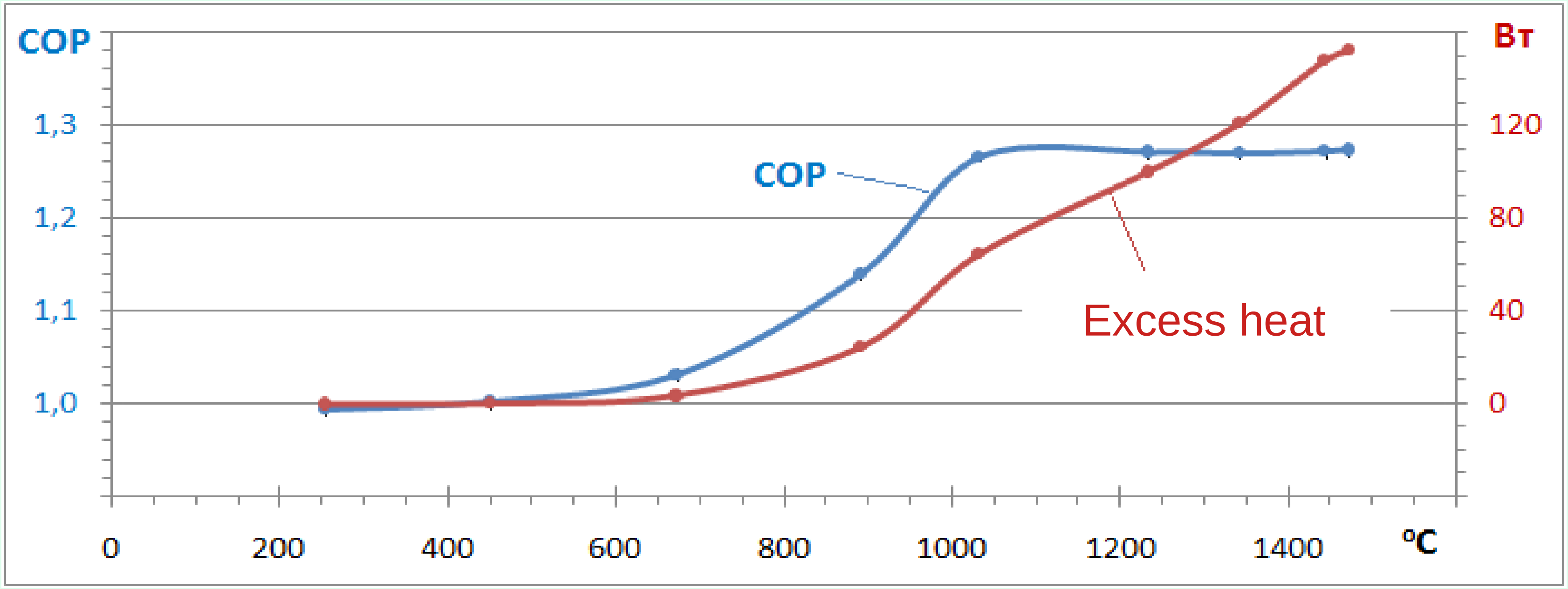


An iron cylinder weighing 60 g is heated by a tungsten coil wound around a sapphire tube. The high-temperature insulation is surrounded by two layers of nickel mesh. Between the layers is 15 g of nickel powder saturated with hydrogen.

The reactor is located in a sealed quartz tube filled with a mixture of hydrogen and argon. A flow-through air calorimeter was used to measure the power of heat release.



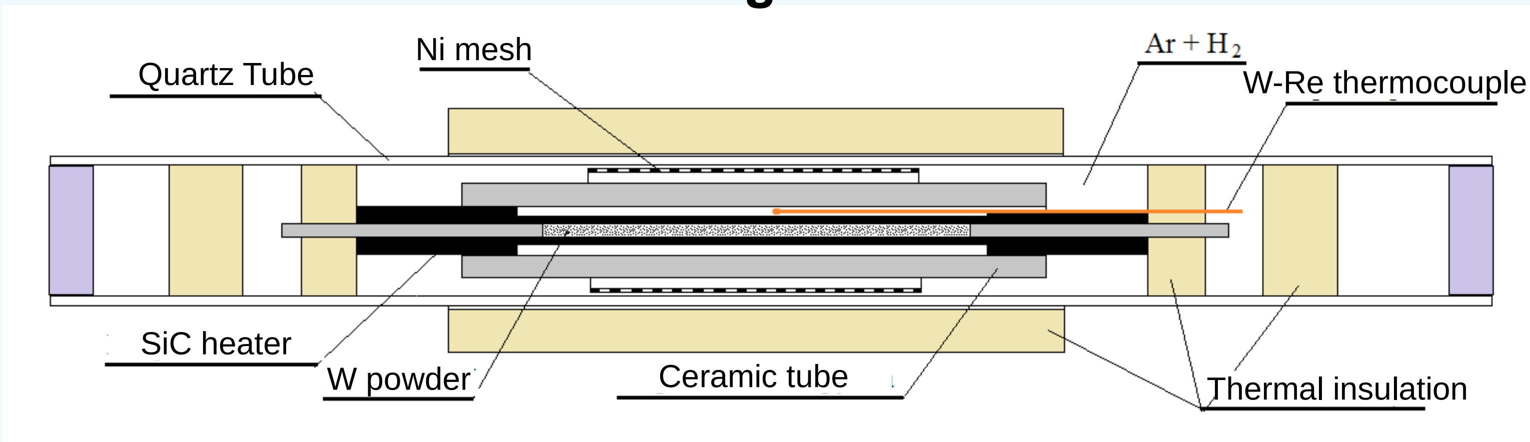
Reactor C3 with tungsten heater and iron core

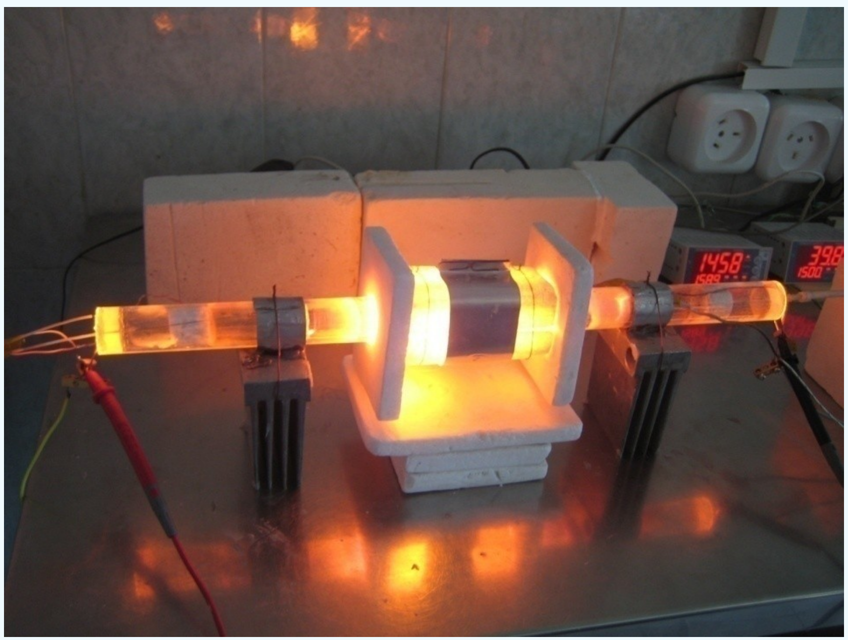


A noticeable excess heat release is observed already at an iron core temperature of 800 ° C and continuously increases with increasing temperature.

The thermal coefficient COP at a temperature of about 1000 ° C reaches a value of about 1.3. The increase in temperature does not lead to an increase in COP due to the rapid increase in the power consumed by the electric heater.

Reactor W1 with tubular silicon carbide heater and tungsten core

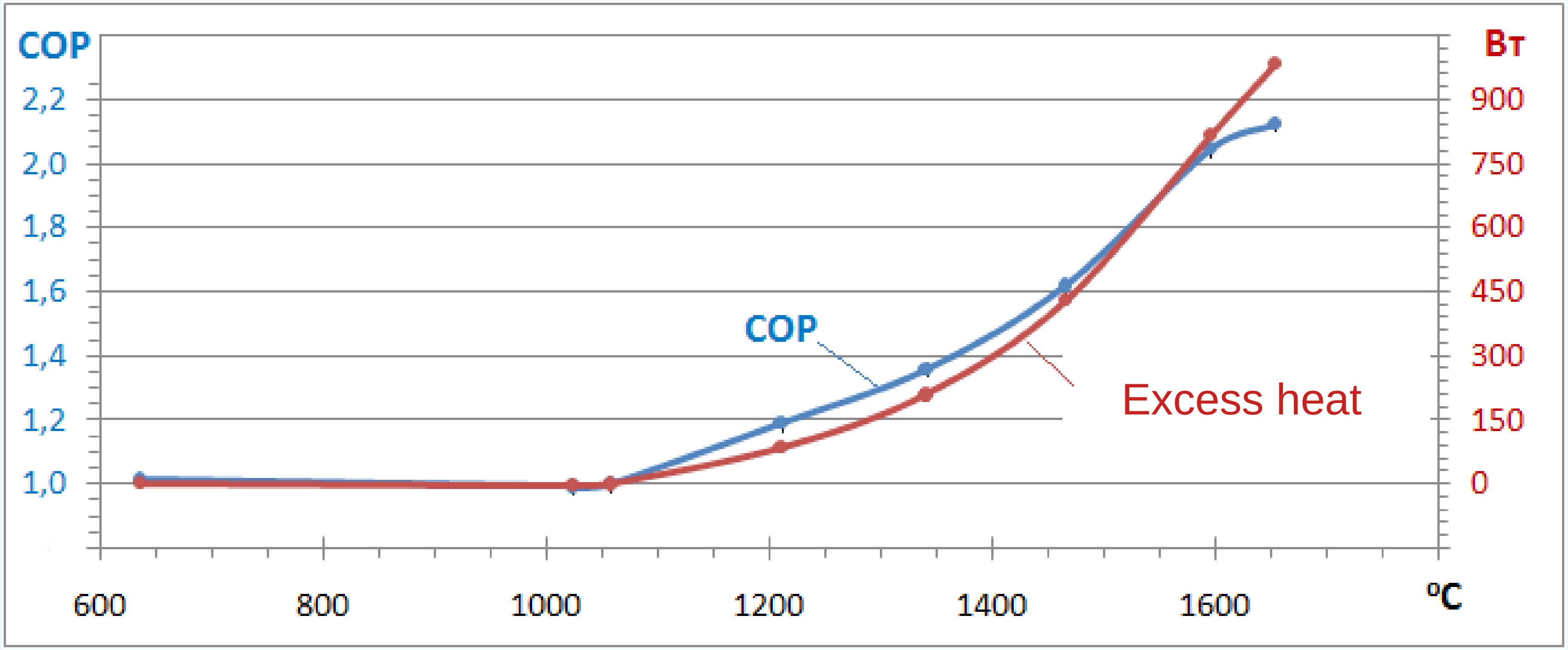




Inside the silicon carbide heater is a tungsten powder weighing 3.1 g. The heater is surrounded by porous ceramic thermal insulation. A hydrogenated nickel grid ("fuel") is located between the thermal insulation and the outer quartz tube.

This reactor was producing up to 1000 W of excess power (COP = 2.1)

Reactor W1 with tubular silicon carbide heater and tungsten core



A noticeable excess heat release appears at a temperature of 1100 ° C and increases with increasing temperature.

The COP also increases, reaching 2.1 at around 1600 ° C. At higher temperatures, growth slows down.

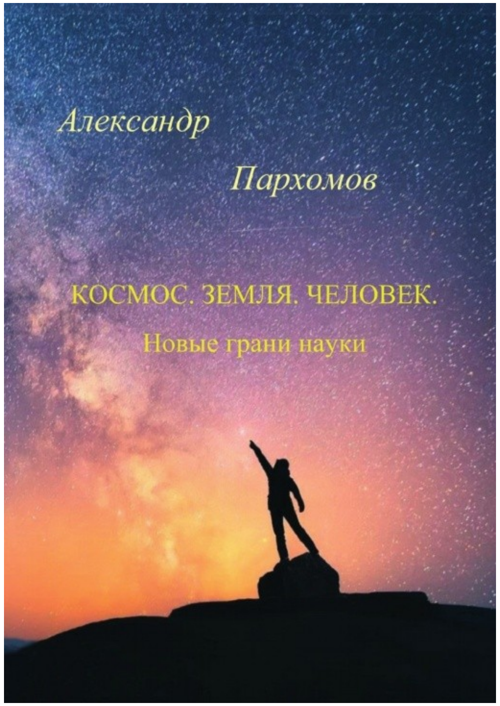
A hypothesis has been put forward about the generation of neutrino-antineutrino pairs in the collision of matter particles at temperatures of several thousand degrees. Especially intense generation should occur in metals and dense plasma. The resulting neutrinos and antineutrinos can excite exothermic nuclear reactions in the surrounding matter.

The source of neutrino-antineutrino (hot metal or dense plasma) can be separated from the "fuel" - the substance where nuclear transformations take place. This opens up the possibility for the design of highly efficient LENR reactors.

Several reactors have been tested based on this approach. Three types of calorimeters were used to measure the heat release power. In all reactors at a sufficiently high temperature of the metal core, the release of heat in excess of the consumed electricity was found.

Changes in the elemental and isotopic composition were found in the material surrounding the region with the hot metal, which confirms the nuclear-physical nature of the observed effects.

Long-term studies in the field of low-energy neutrinos are described in the book



After reading this book, you will learn that "dark matter" is not just an elusive substance dissolved in the infinite Universe, it is an important carrier of connections between the Cosmos and the Biosphere.

You will learn how you can experimentally determine the size of the Galaxy using a diffraction grating. You will learn about black holes in the bowels of the Earth. You will learn about the properties of the mysterious flicker noise and how it relates to earthquakes, avalanches, solar activity, revolutions and many other natural and social phenomena.

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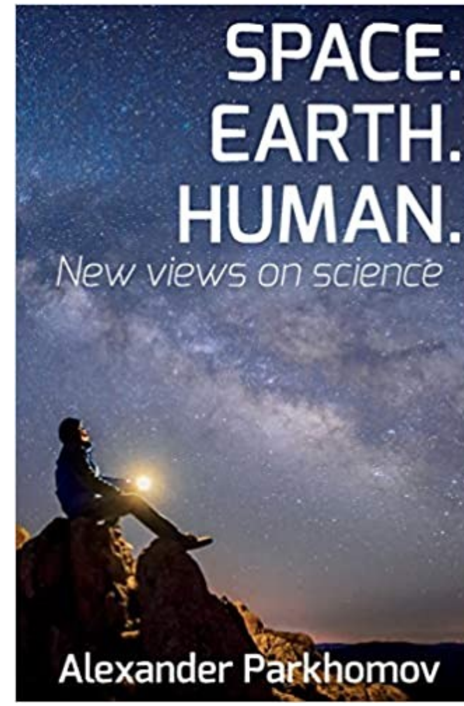
You will learn that you can control not only the intensity of processes, but also the degree of their chaos and orderliness. Learn about the author's experiences in parapsychology and why he moved away from these intriguing studies.



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