Report n. 13

Aprile 2015

Experimental Tests on Energy Localization: Anomalous Effects of High Voltage, Narrow Pulsed Electrical Discharges on Metal Powders, in Electrolysis and Gas

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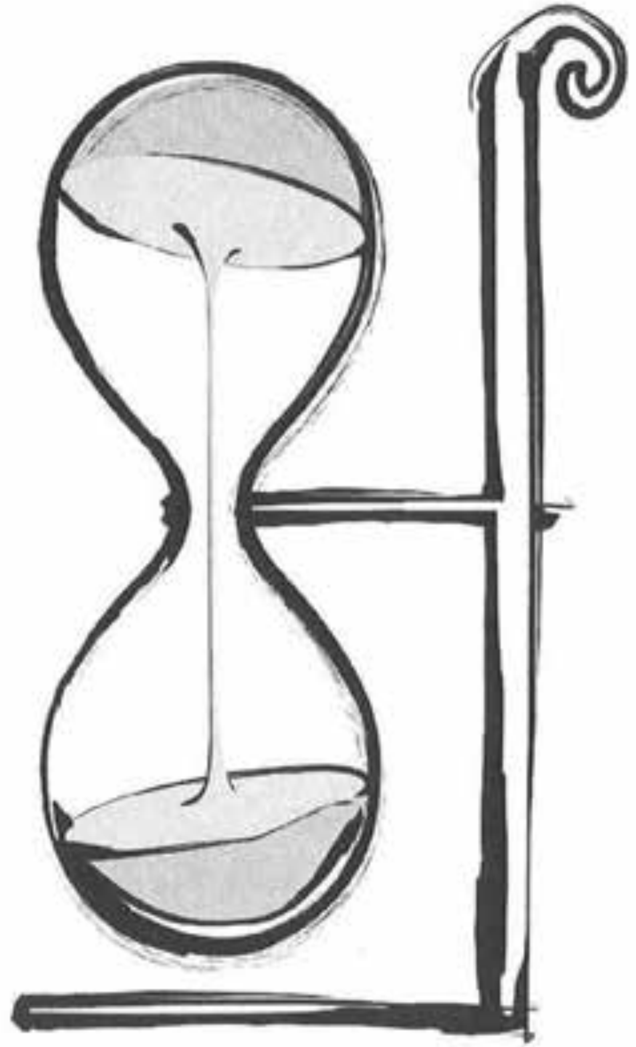
Reversibility vs Irreversibility



Abstract

With the goal of determining the conditions to promote some anomalous effects (thermal and electrical) shown by metals in the presence of hydrogen gas or during electrolytic evolution, we focused the attention on the use of high voltage, narrow electric pulses, with low repetition rate, on small sized metal powders.

The experimental data collected during the experimentation, relative to cathodes made from tungsten micrometric powders subjected to electrolytic regime (solutions of K_2CO_3) at voltages up to 350 V and the average power of 200-300 W, show the *spontaneous* formation of pulses of high instantaneous power, up to 30 - 40 KW, in conjunction with abnormal development of heat.

Moreover, we was able to perform a *direct* extraction of a part of the electric energy contained in such plasma pulsations, by a suitable circuit, in the so called “negative resistance” region.
These data have suggested the design of a suitable reactor and its experimental set-up, for the extension of the experimentation to nanometric powders made from different metals, subjected to *programmed* high voltage narrow impulsive discharges, in the hydrogen gas.
Some results of the experiments, conducted varying the composition and particle size of the metal powders, the hydrogen pressure and the characteristics of impulsive discharges, will be shown in the conference.
The results will be framed in the context of the theory of "Energy localization".

Acknowledgments

Many thanks go to the numerous researchers who have given us their support. Because of the impossibility to expressly mention all, we are glad to thank explicitly at least dr. Francesco Celani, INFN Frascati, for the remarkable effectiveness of the advice and moral support received.

PERSPECTIVES
in nuclear synthesis research work

Some our preliminary considerations suggested the possibility to search for high energies trying to establish steady resonance conditions at high frequencies.

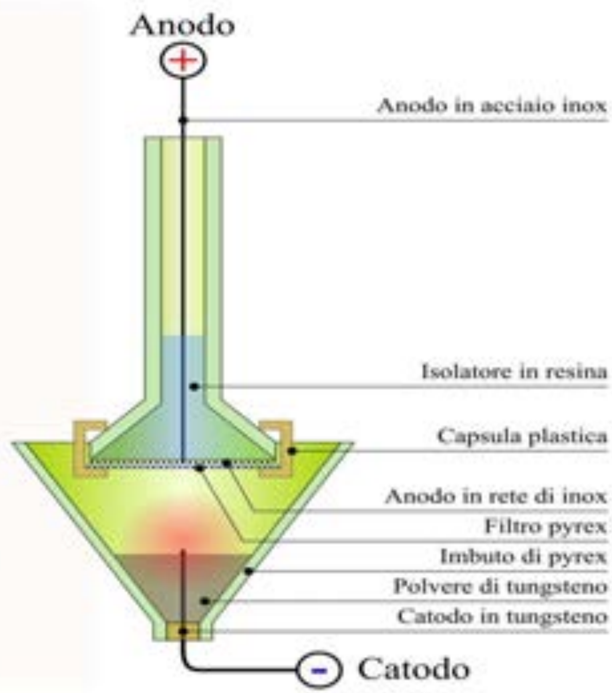
Then the work followed four directions:

- exploiting the natural oscillations of electrolytic plasma;
- fine-grain structuring of the reactive material to activate stable resonances at very small wavelengths;
- soliciting the reacting system by high frequency forcing pulses;
- employing mixtures of different materials to trigger energy localization.

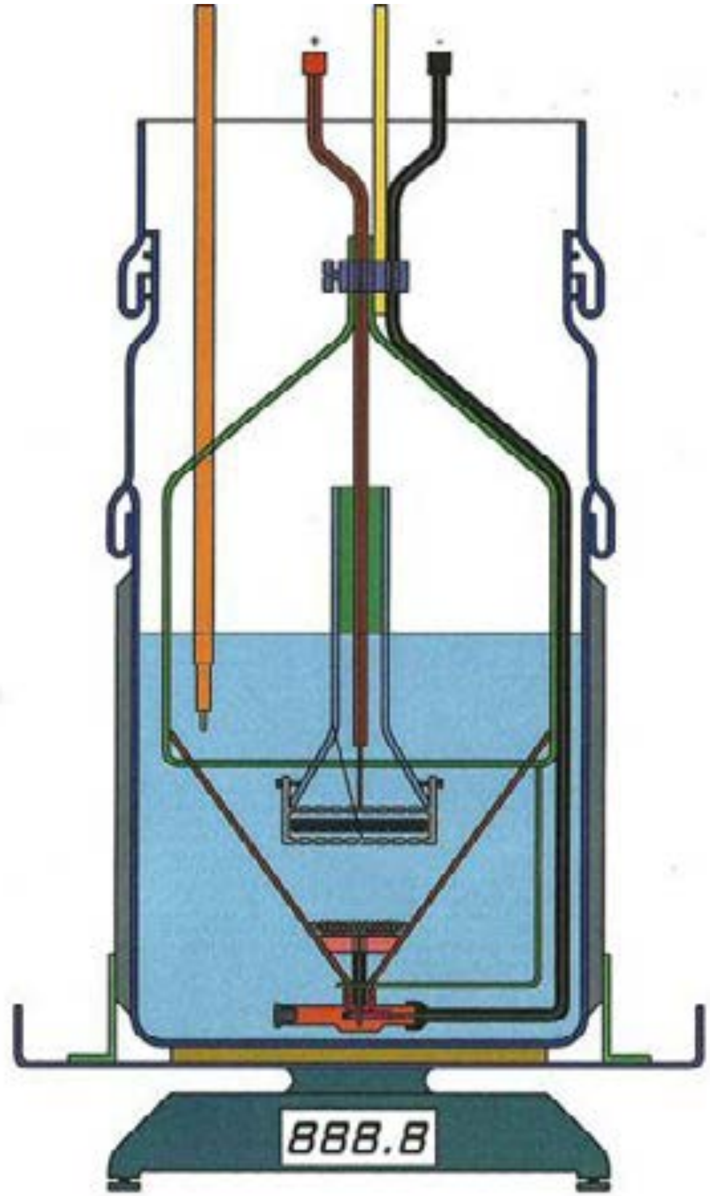
SOME EXPERIMENTAL RESULTS

In 2012, in the Physics Lab at “L. Pirelli” High School, in Rome an experimentation begins by a group of teachers and students

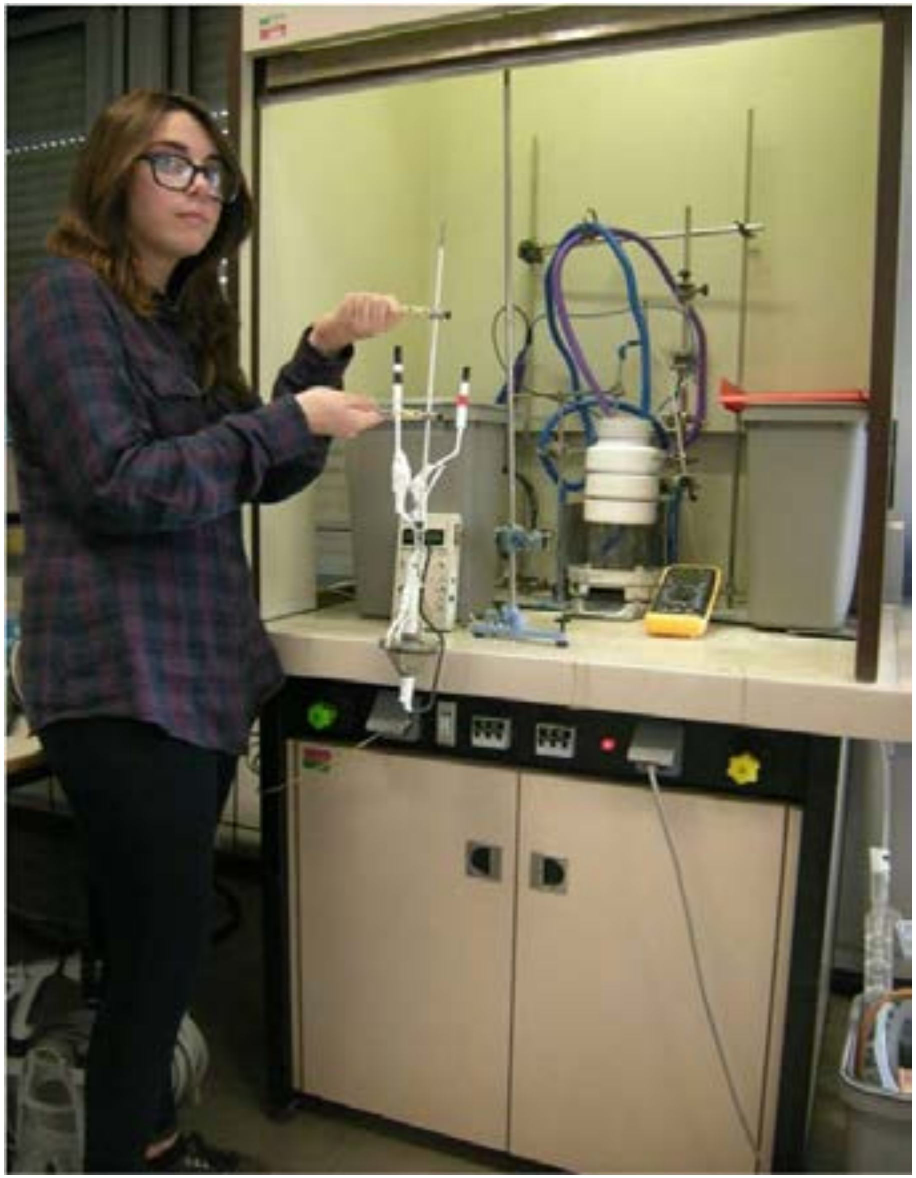
Athanor reactor (anomalous heat excesses)
inox mesh (anodic) and a tungsten cylinder (cathodic) in an aqueous solution of K_2CO_3 running in electrolytic plasma



Athanor Reactor



Athanor reactor (IIS L. Pirelli)



Hydrobetatron

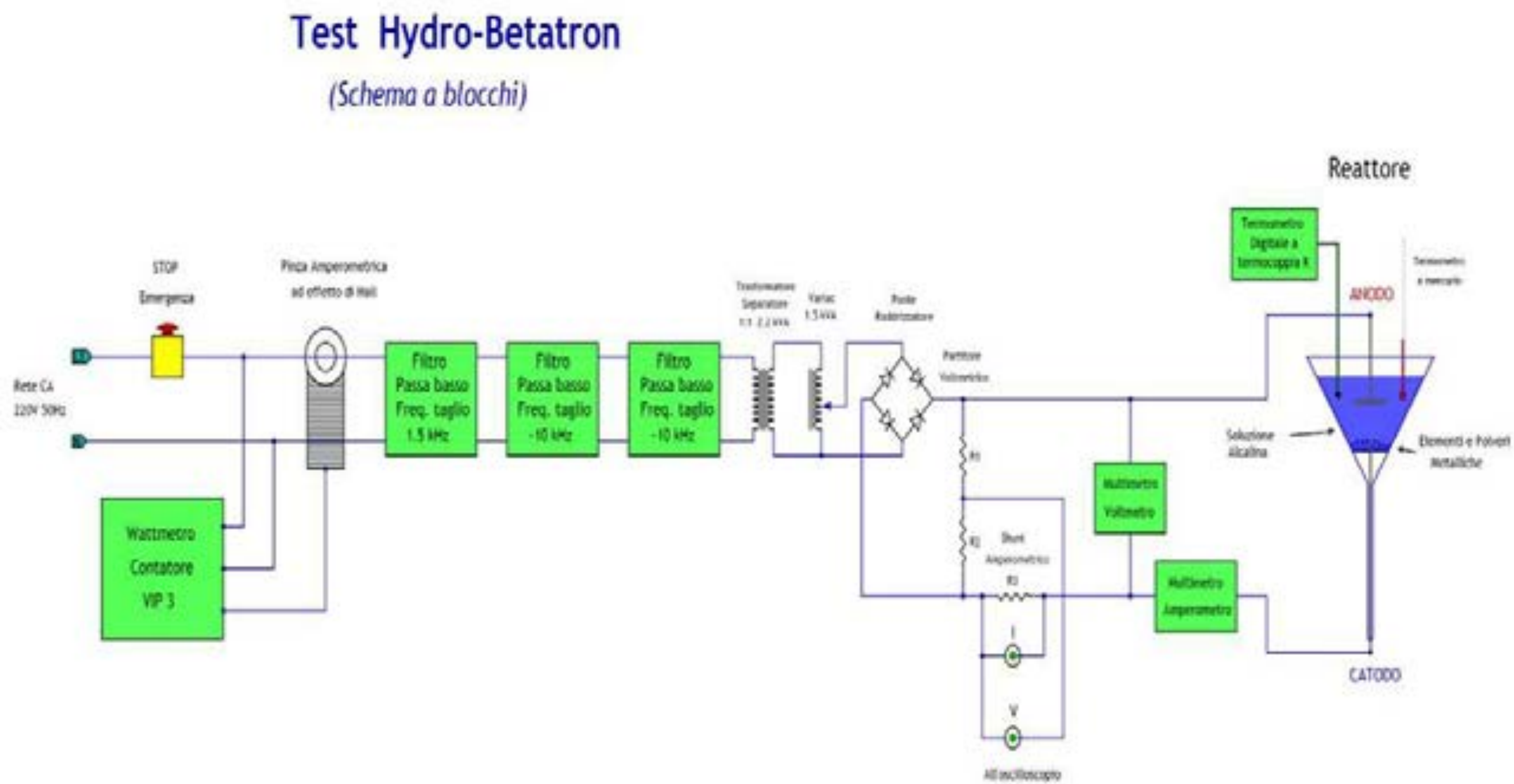
experimental campaigns

at *J. Von Neumann Foundation* Lab in Rome

From **Athanor** to its heir **Hydrobetatron 1.0** reactor

(special powder cathode)

Experimental set up



The reactor operates in an self-referential way:

If the powder surface exceeds a minimum threshold, the current density is insufficient to ignite plasma, all the power (exceeding the electrolysis demand) heats the solution by Joule effect (the graph of input power W_{in} vs solution equilibrium temperature is about superimposable at the one related to heating by a resistor)

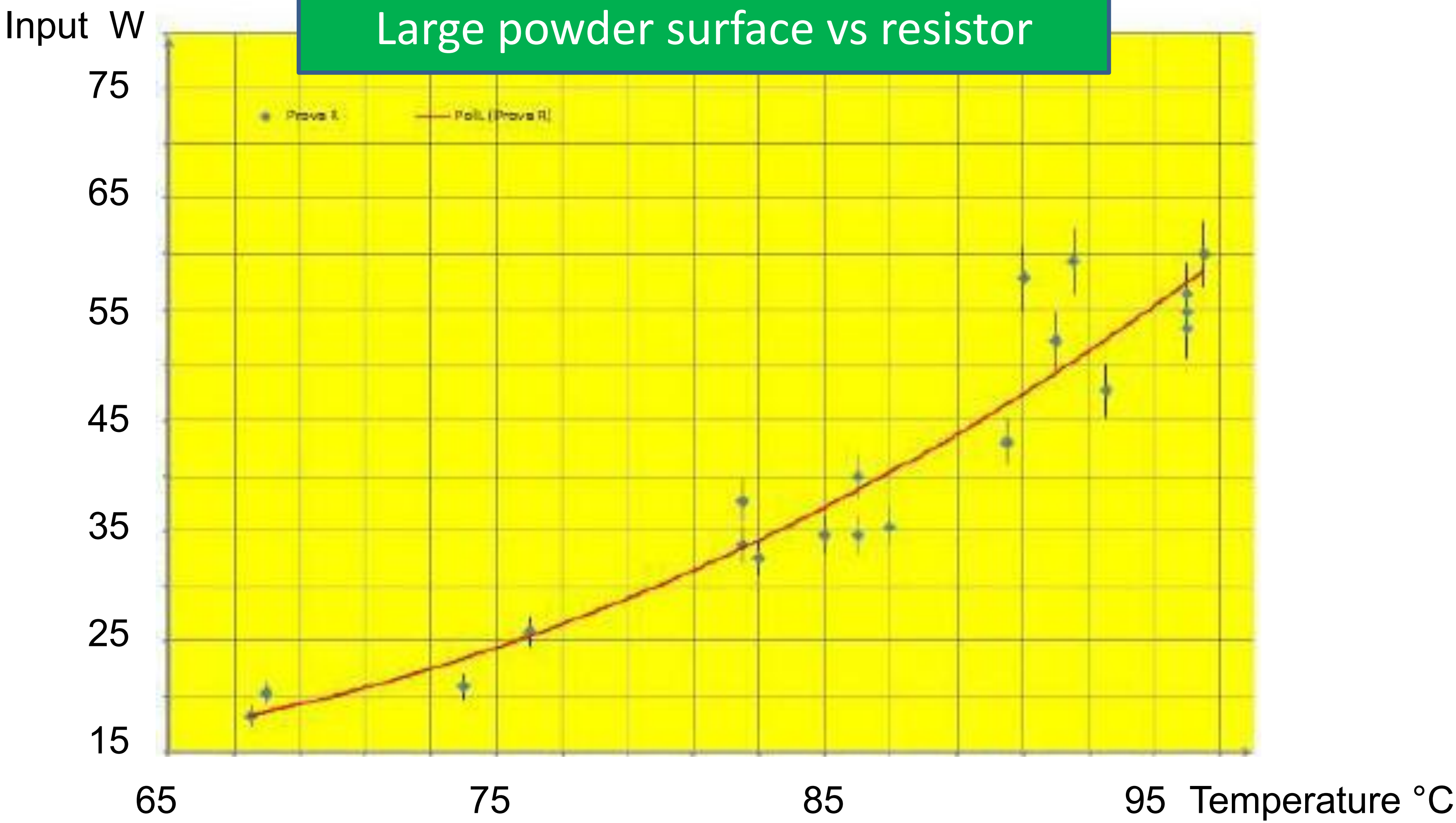
If the powder surface is less than the threshold, electrolytic plasma occurs.

At temperatures exceeding about 70°C

Input power W_{in} vs the reactor equilibrium temperature:

- always in the b) case, less than in the a) case
- increasing distance between graphs as T increases
- In particular, a specific cathodic composition of grains, needles, micropowders behaves optimally showing, at a same T_{eq} ,
a ratio W_{in} (a) / W_{in} (b) ≈1.3

Large powder surface vs resistor



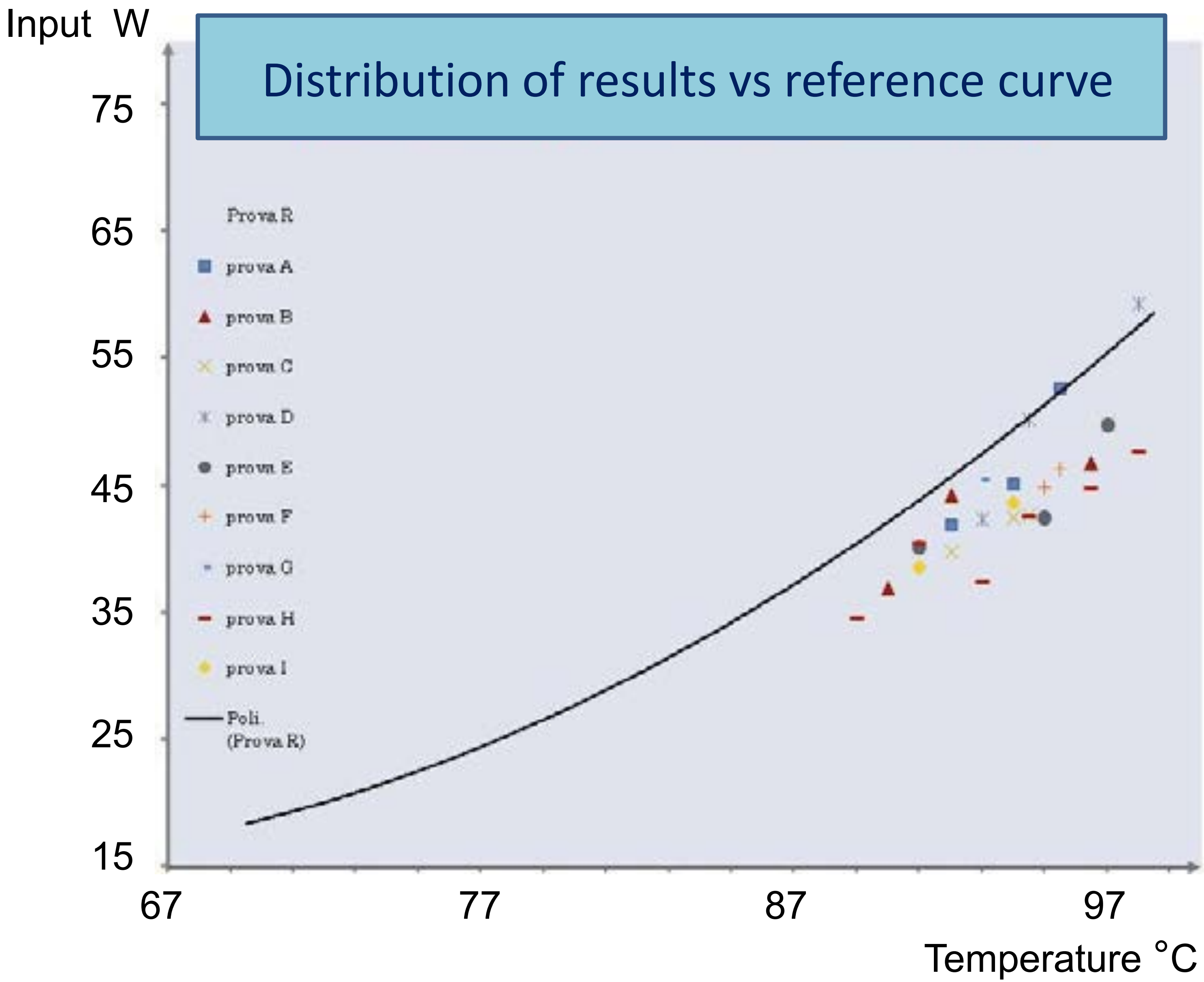
Reference graph

Self-referring tests

Sample composition **run R (reference) – no plasma**

Grains /Powders	0g	1g	2g	3g
0g	A	B	C	
1g	D	E	F	
2g	G	H	I	
3g				R

Distribution of results vs reference curve

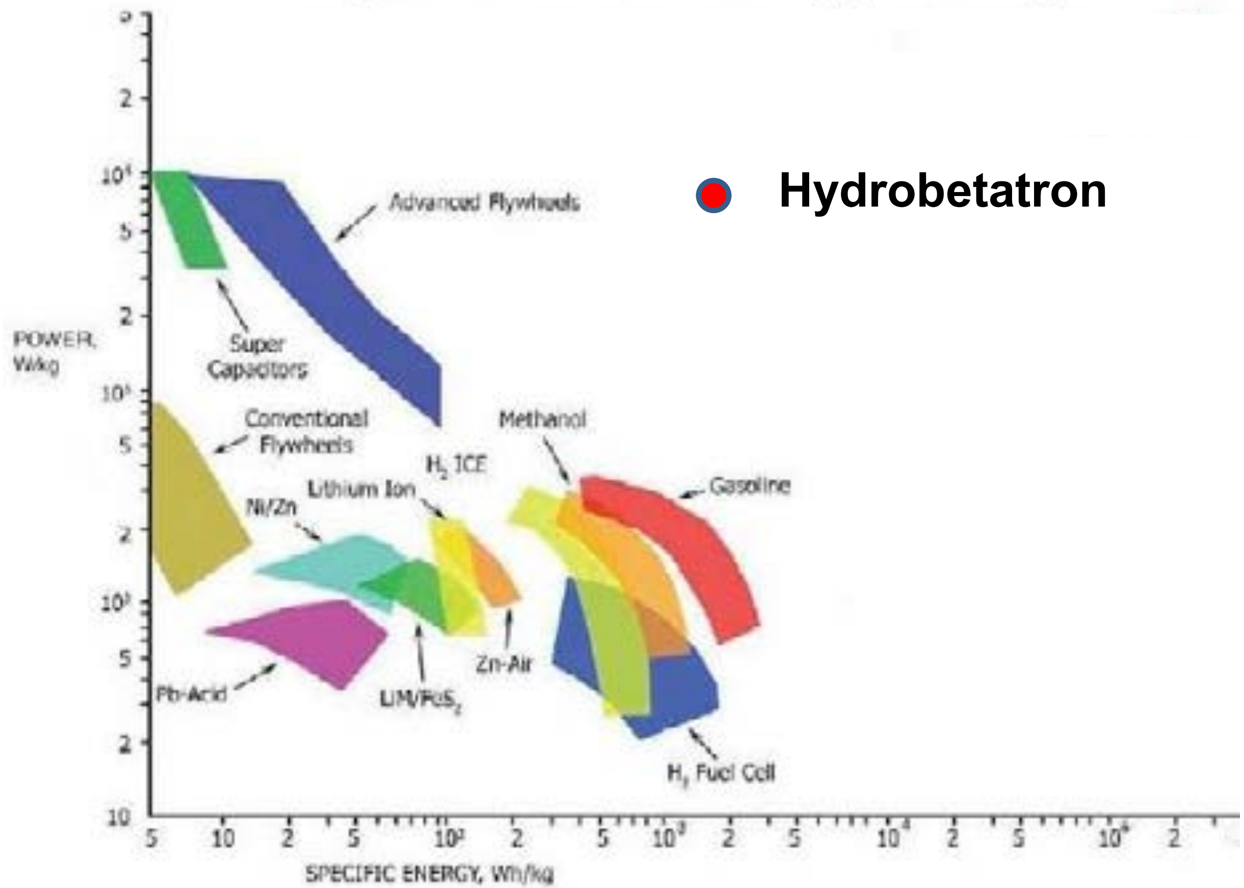


Subject: LENR heat anomaly in electrolytic plasma

Excitation mode: electrical, DC
Equilibrium temperature after 10 minutes
Mean input power **38 W**
Mean output power **48 W**
COP (definition) = reference power/input power **Max COP = 1.26**
Input energy 22800 J
Output energy 28800 J
Excess energy 6000J

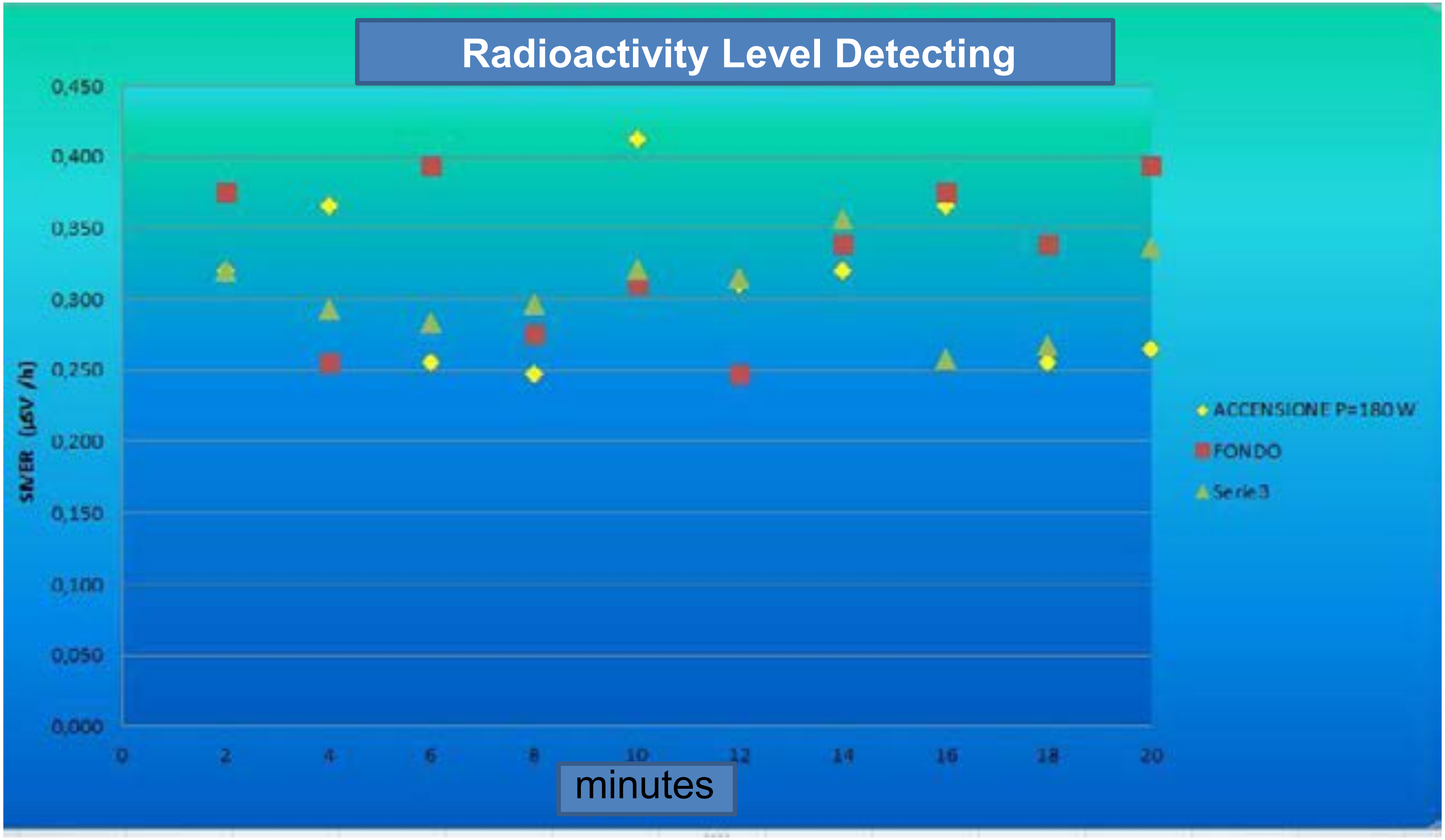
Power density 10000 W/Kg
Specific energy 1650 Wh/Kg

Ragone Plot of Energy Storage

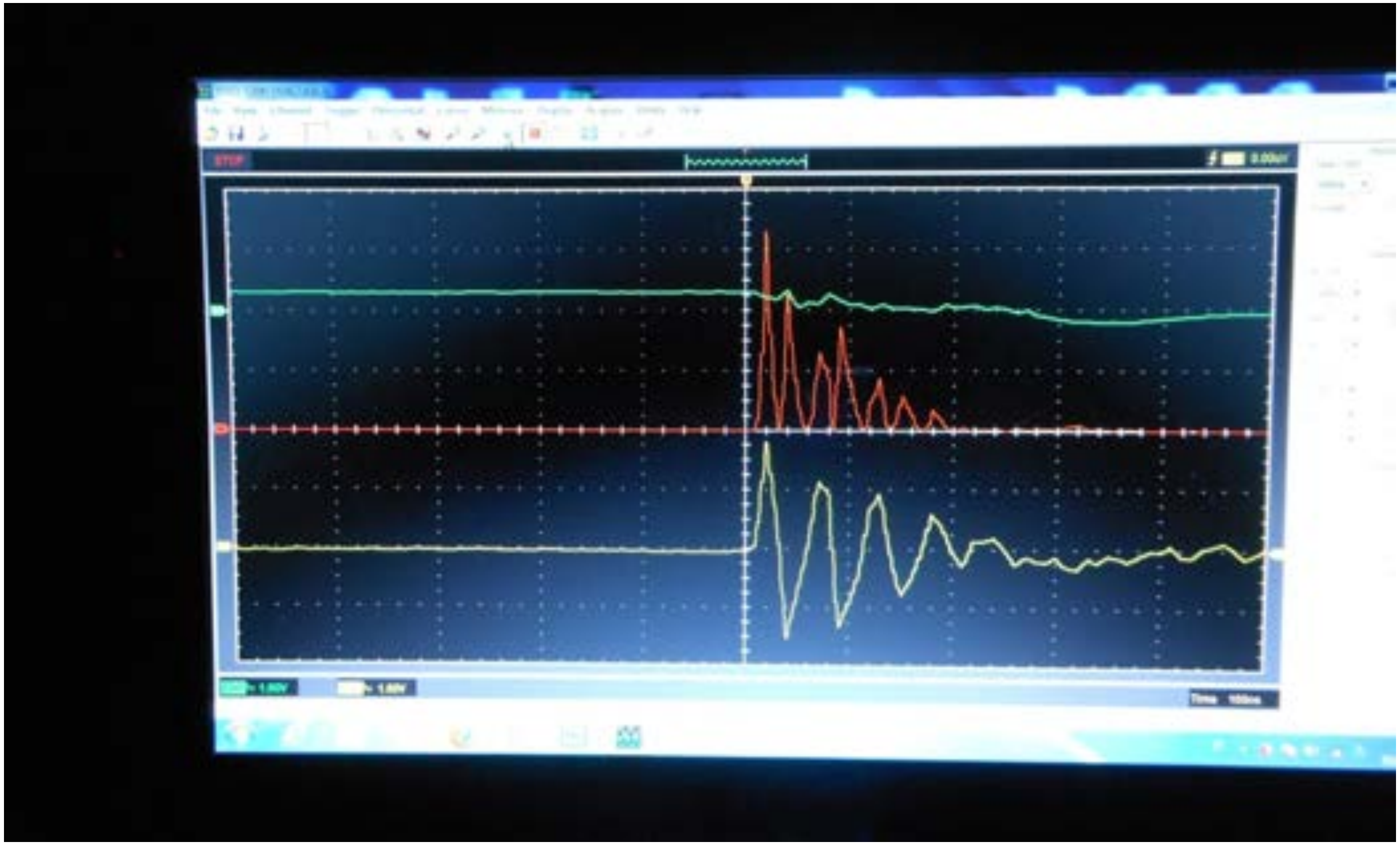


F-Pulsator, J.Von Neumann Lab

continue monitoring does not show any **gamma rays** emission

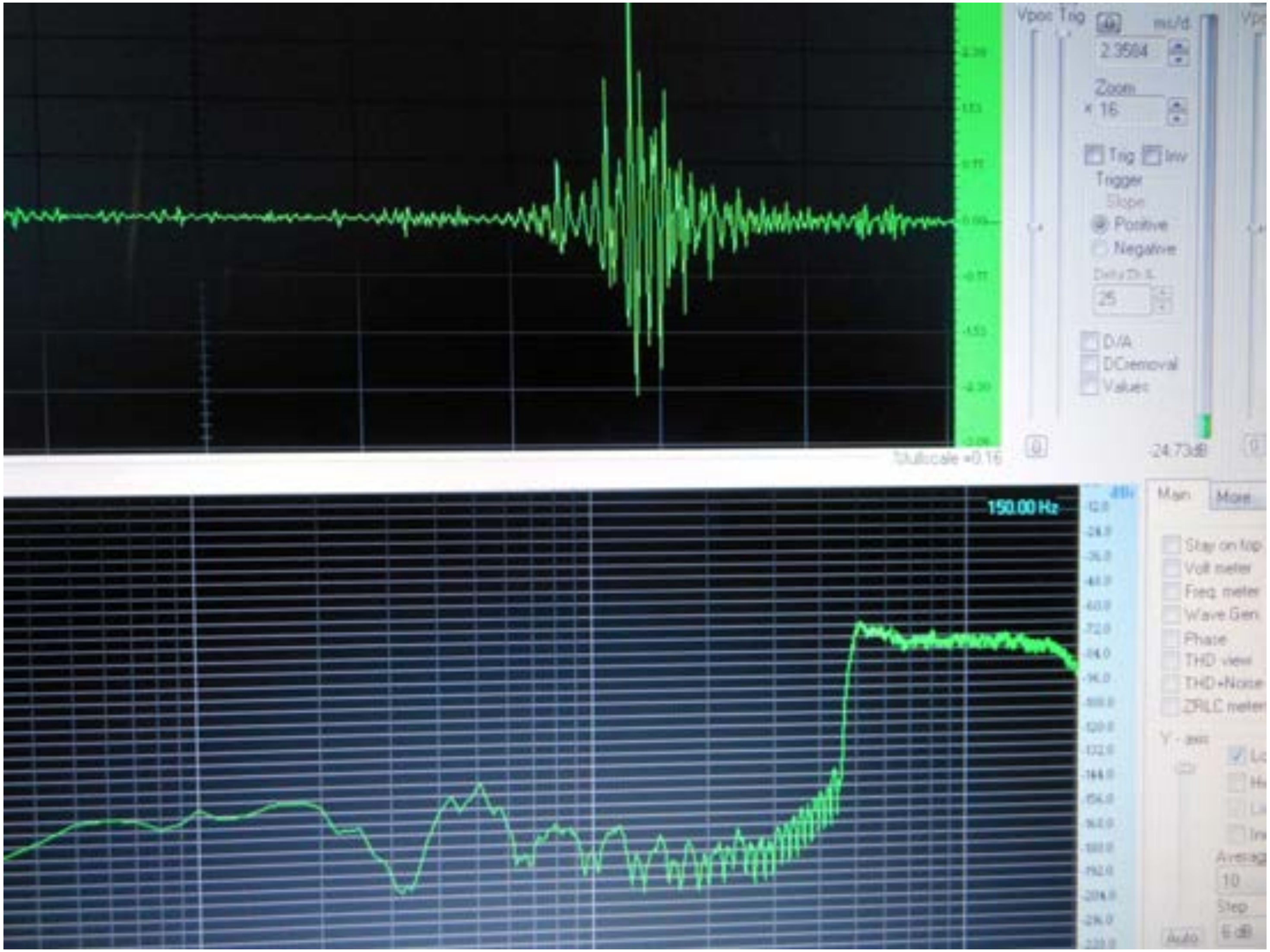


In the plasma phase, by recording and analyzing the electric and acoustic power oscillations induced by plasma, we find electric pulses, 10 – 20 nanoseconds long, carrying **instantaneous** power up to **40 KW**, while the **mean** input power is about 200 W.

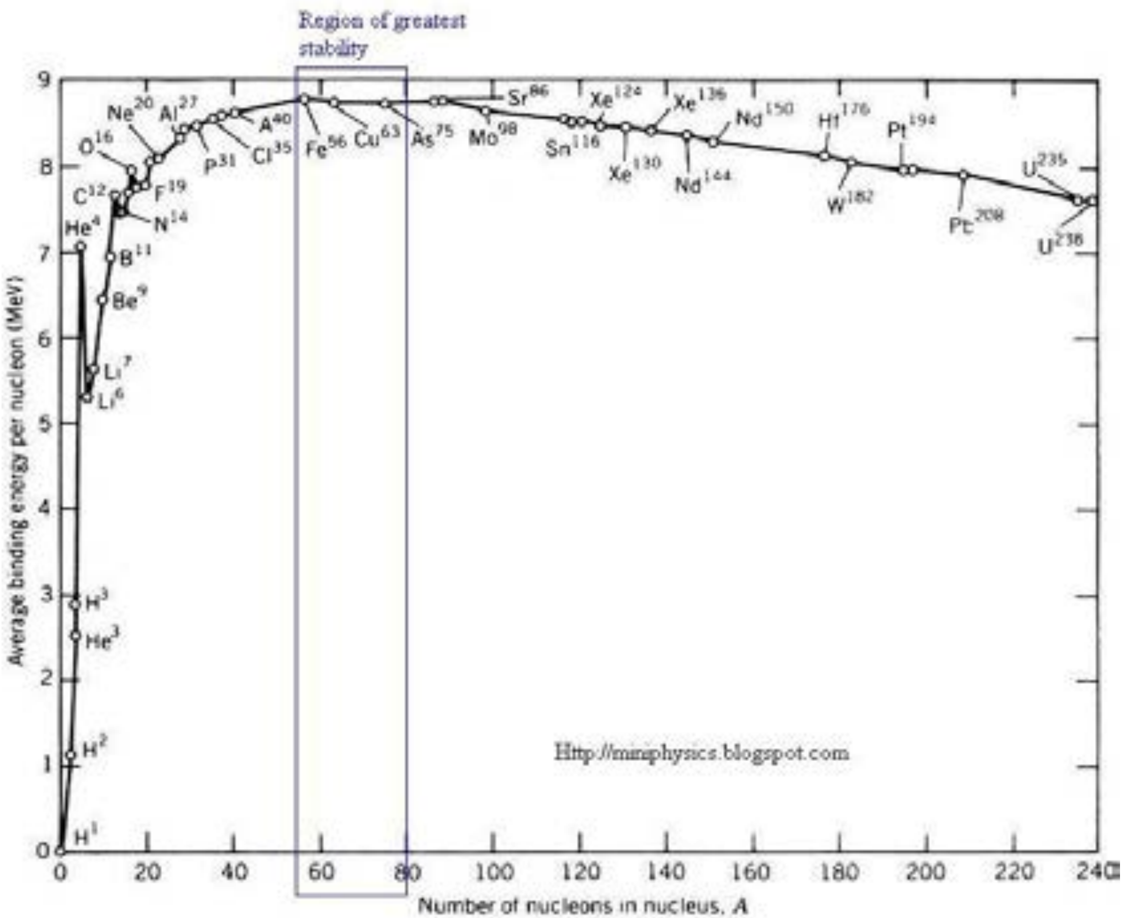


Oscilloscope – time division 100 nsec

Acoustic oscillations



By relating the corresponding energy to the fluid volume inside the sound wave front during the above times, volumetric energy densities are valued **comparable** to the nuclear binding ones, per nucleon.

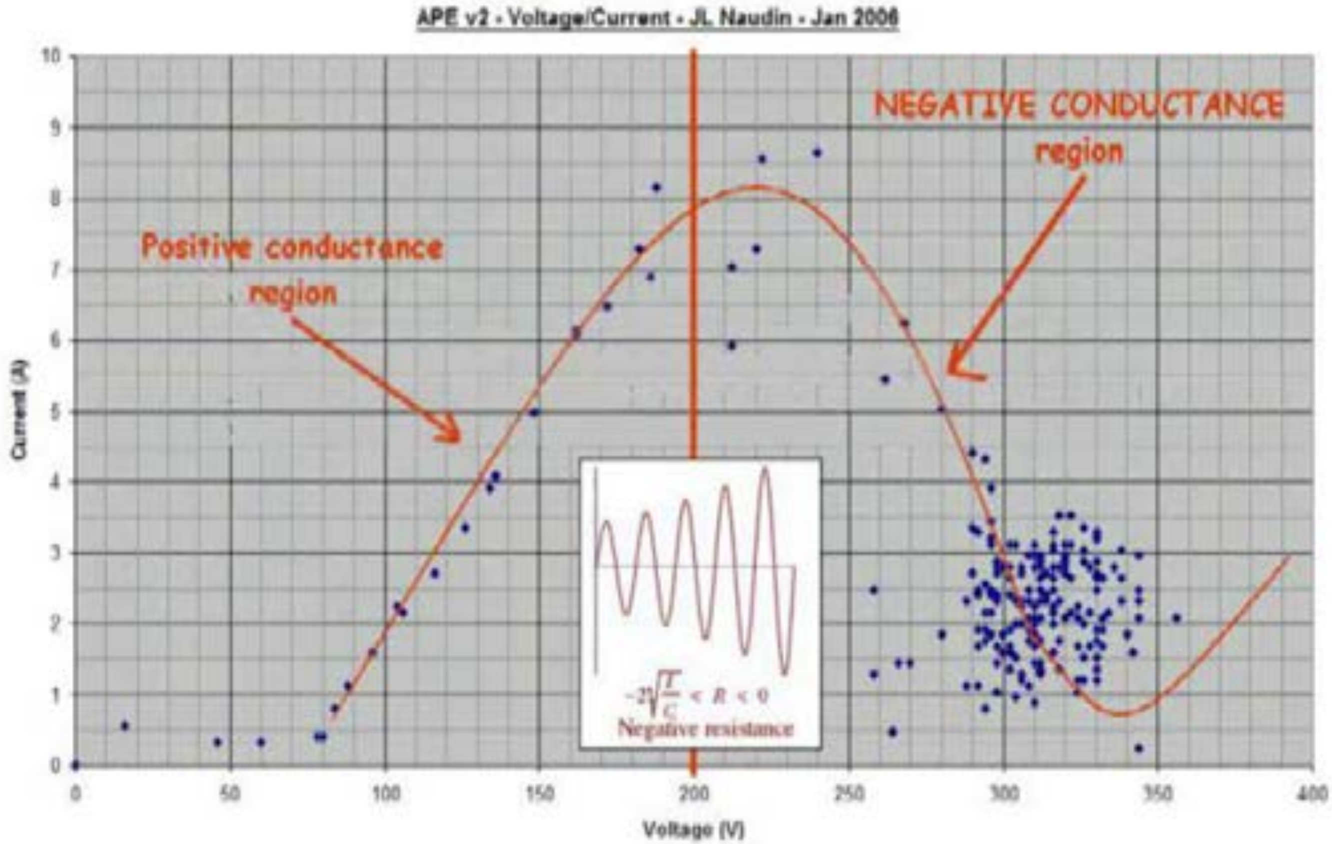


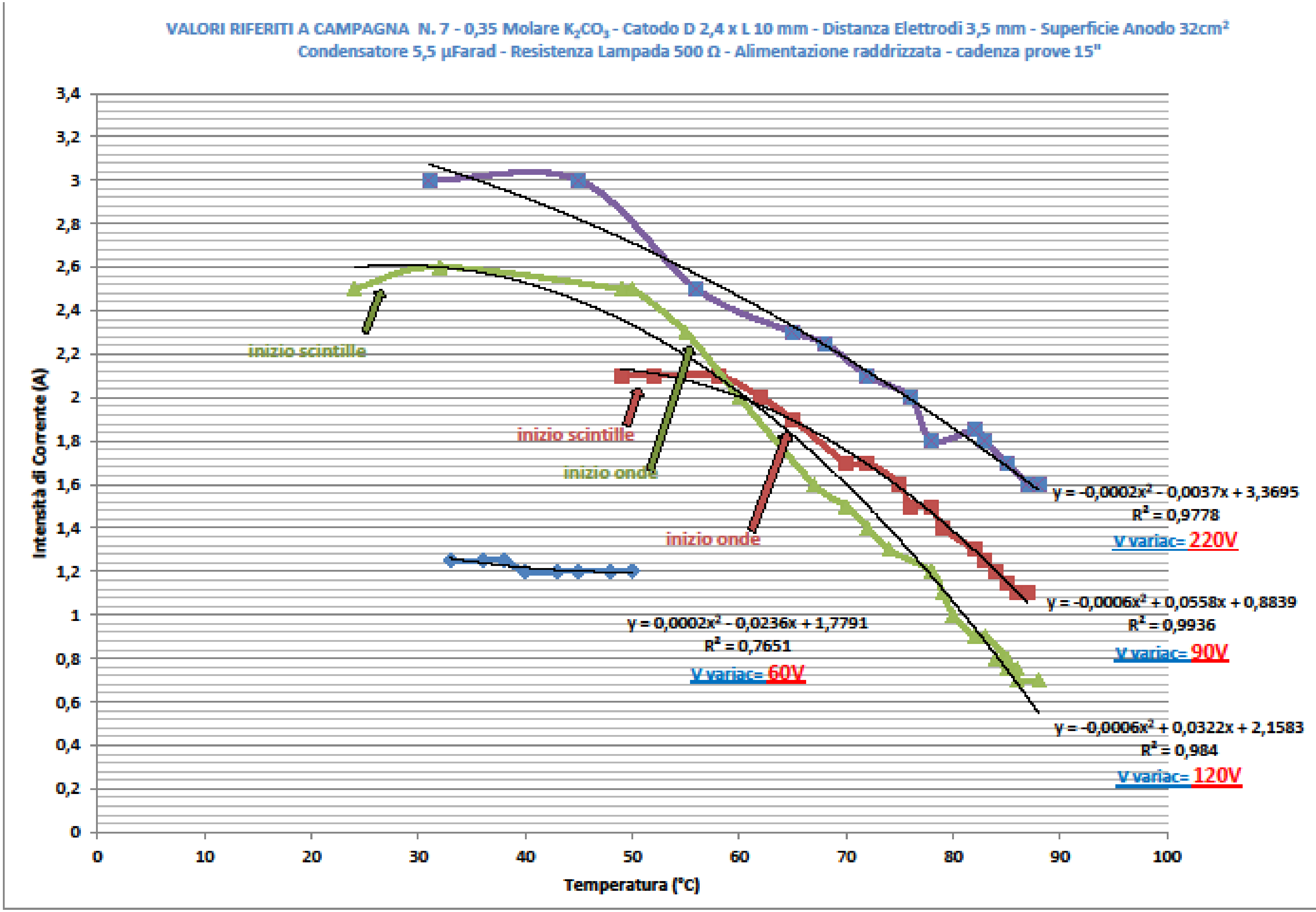
Hypothesis: electroinduced cavitation

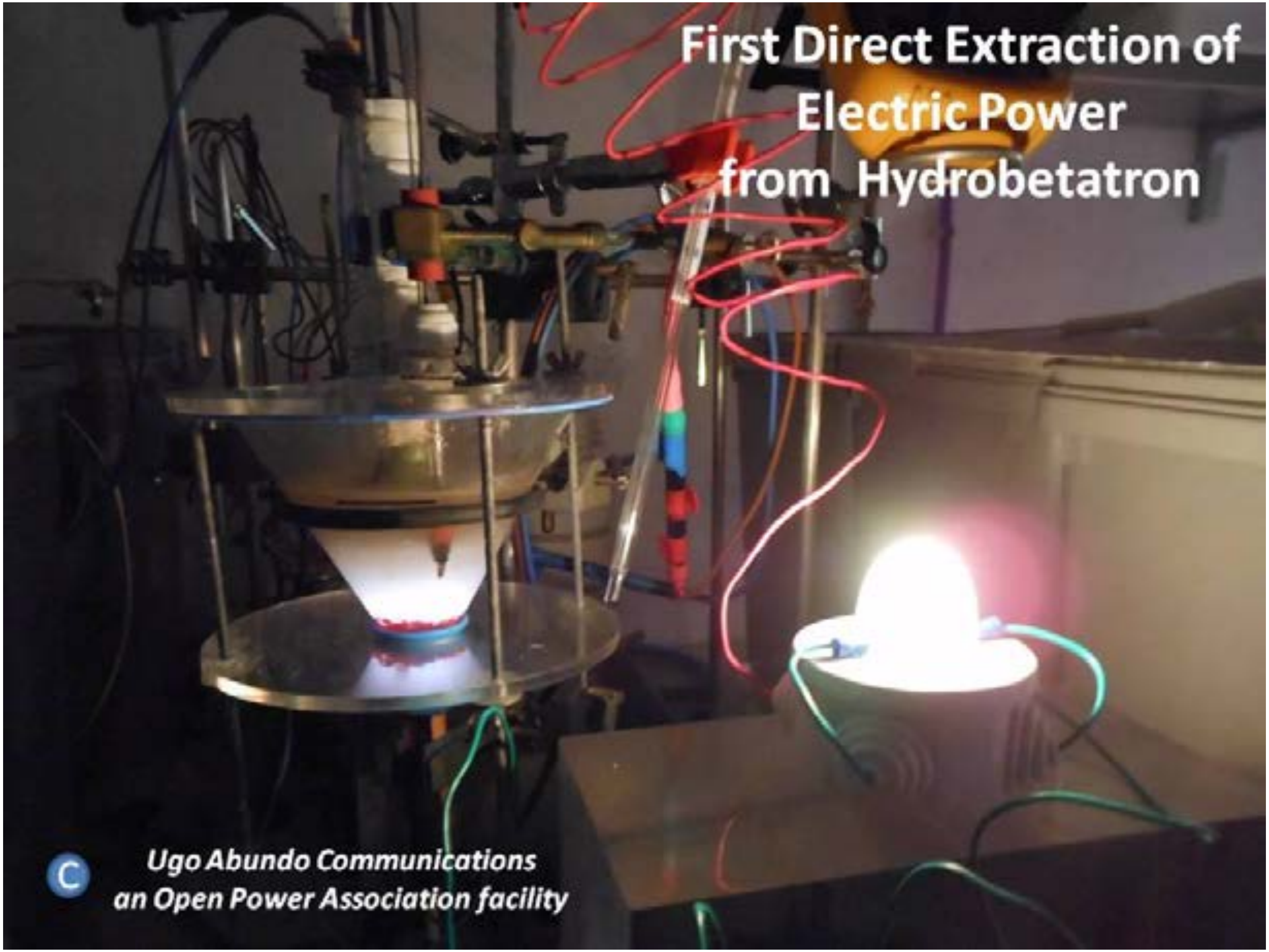
Critical Densities computing (magnitude orders)

- **Critical nuclear binding pressure (per nucleon) : 100 M Pa**
- **Power peak: 10^4 Watt (micropowder radius: 50×10^{-6} m)**
- **Sound speed in water: 1500 m/sec (1800 for the shock wave)**
- **Dimension involved with the shock wave in 10 nsec : 10^{-5} m**
- **Involved volume: 10^{-15} m^3**
- **Spike energy: 10^{-4} J**
- **Volumetric energy density : 10^{-4} J /10^{-15} m^3 = 10^{11} Pa = 100 G Pa**

Dealing with the possibility of direct electric energy extraction from plasma, an extensive experimental campaign, using a suitable RC circuit connected in parallel to the electrodes, by varying shapes and dimensions of the electrodes, electrolyte concentration, interelectrode distance, voltage, reactor temperature and extraction circuit characteristics, shows the presence of regions where occurs the so called (improperly) phenomenon of "negative resistance", i.e. the complexity of involved phenomena is combined to show a current drop vs an increase of interelectrode voltage: in such a condition, several authors put the possibility of extracting power from plasma, by collecting the fluctuations spontaneously autotriggering, as well as actually our data confirm when the circuit is closed on a lamp as load.


APE v2 - Voltage/Current - JL Naudin - Jan 2006
NEGATIVE CONDUCTANCE region
Positive conductance region
Current (A)
Voltage (V)
$-2\sqrt{\frac{L}{C}} < R < 0$
Negative resistance


VALORI RIFERITI A CAMPAGNA N. 7 - 0,35 Molare K2CO3 - Catodo D 2,4 x L 10 mm - Distanza Elettrodi 3,5 mm - Superficie Anodo 32cm²
Condensatore 5,5 µFarad - Resistenza Lampada 500 Ω - Alimentazione raddrizzata - cadenza prove 15"
Intensità di Corrente (A)
Temperatura (°C)
inizio scintille
inizio scintille
inizio onde
inizio onde
y = -0,0002x² - 0,0037x + 3,3695
R² = 0,9778
V variac= 220V
y = -0,0006x² + 0,0558x + 0,8839
R² = 0,9936
V variac= 90V
y = 0,0002x² - 0,0236x + 1,7791
R² = 0,7651
V variac= 60V
y = -0,0006x² + 0,0322x + 2,1583
R² = 0,984
V variac= 120V


First Direct Extraction of
Electric Power
from Hydrobetatron
Ugo Abundo Communications
an Open Power Association facility

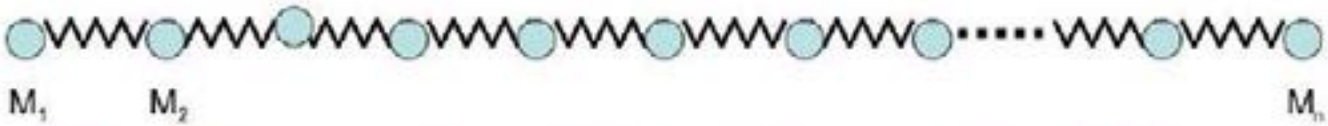
Actually (**Hydrobetatron 2.0**) experimentation is continuing by studying about the effect of a deliberately pulsed solicitation, variable in amplitude, ascent slope, pulse duration, repetition frequency, duty-cycle (proprietary pulse device) on nanometric composite structures (sintered cathodes from multicomponent powders, electroplated multilayers, and so on) both in electrolytic or hydrogen plasmas, under the effect of magnetic field.

We turn now to examine the hypothesis of B. Ahern about the energy unbalancing

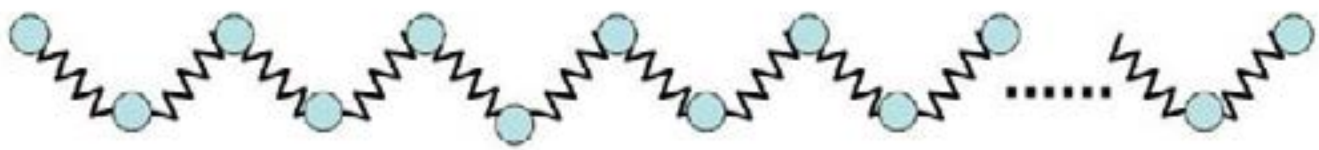
(http://www.slideshare.net/ecatreport/ahern-lenr-theories)

As already E. Fermi sensed in 1954, the particles of nanometric dimensions have a number of atoms insufficient to ensure a statistic that obeys monotonic evolution towards equilibrium. B. Ahern assumed that, in conditions of the arrangement of atoms mainly on the surface, the number of atoms in the body of the particle exerts a damping insufficient and the oscillations can differ from harmonic ones, showing locations of greatest energy at the expense of that of other areas, not respecting the principle of equipartition

Enrico Fermi, 1954 Los Alamos   MAINIAC I



Ideal Springs obey Hooke's Law $F= -k_1X$

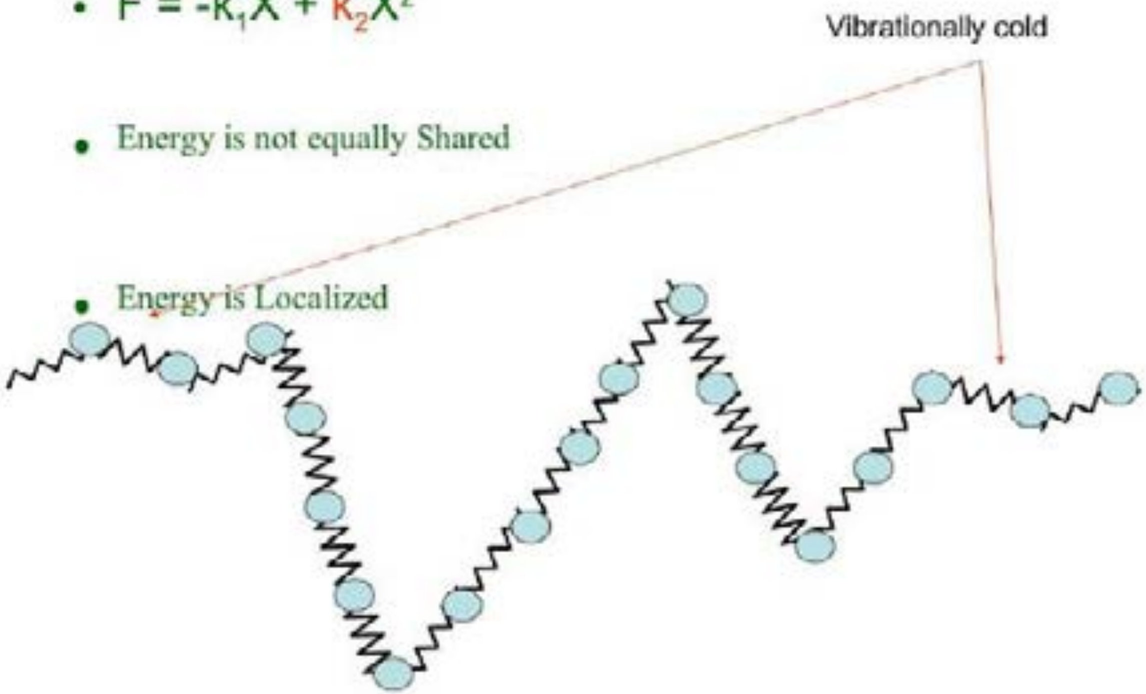


Equipartition of Energy

Every mass has the same vibrational energy

Non ideal springs

- $F = -k_1X + k_2X^2$
- Energy is not equally Shared
- Energy is Localized



P.Soininen, in (http://www.google.com/patents/WO2013076378A2?cl=en&hl=it)

shows a simulation extracted from http://juluribk.com/2011/04/09/electric-field-in-metal-nanoparticle-dimers/ in which are expected electric fields, in the neighborhood of the gaps between nanoparticles, up to four orders of magnitude greater than the mean field.

Importance of the structure of the reactants and of the solicitations

During the experimental campaign at the "L. Pirelli " Instruction Institute (September-December 2011) emerged that mixing iron micropowder to tungsten one improved the excess heat, like adding inert powder (alumina); the maximum was obtained with Fe and W of two different grain sizes mixed, noting also great spontaneous spikes in current that suggested of subjecting the reagents to electrical pulses deliberately created .

The goal to achieve high energy density (in space and time) is therefore pursuing by using nanometric structures with many components, exploiting the interface potentials and soliciting the material (from plasma to laser, ultrasound, electric fields, magnetic, high frequency waves, etc.); the interposition of inerts among the active granules is used to maintain nanometric size, and prevent the sintering.

The addition of pyro-piezoelectric materials, or magnetoelectric, that P.Soininen in his patent (http://www.google.com/patents/WO2013076378A2?cl=en&hl=it) proposes to self-generate electrical pulses due to thermal gradients, can be conveniently examined in the light of the inverse effects, to generate localized concentrations of energy induced by pulsed electrical supply.

F. Celani, G. Vassallo et al. agree (ICCF18, July 2013) (http://www.francescocelanienergy.org/files/Presen_Finale-ICCF18Celani_E.pdf) both theoretically and experimentally with the vision of Ahern about the importance of pulse-solicited nanostructures.

B. Ahern (May 1995) (http://www.archpatent.com/patents/5411654) shows, among others, examples of alternating nanolayers Cu / Ni and Ni / Pd subjected to pulsed electrolysis.

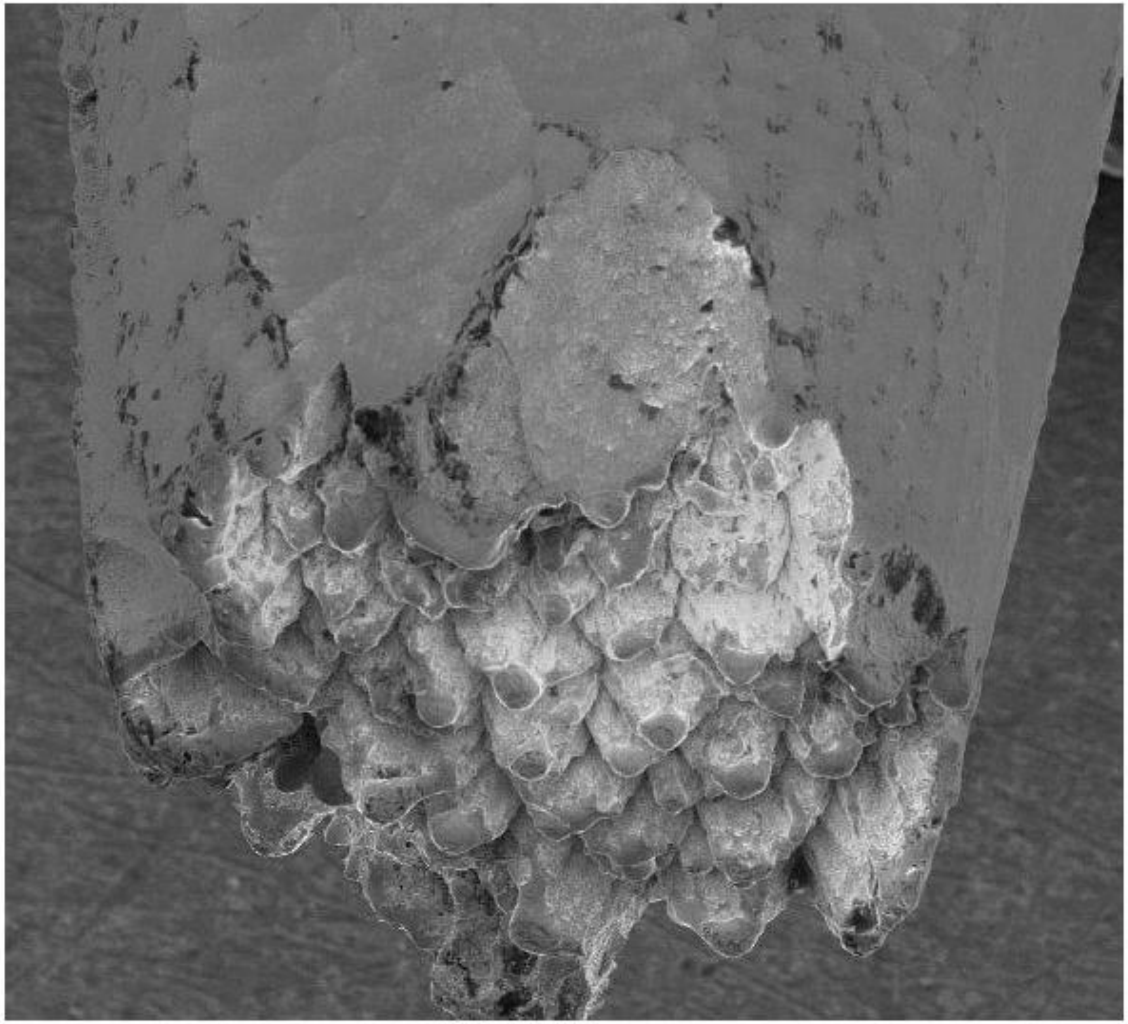
G.H. Miley (November 2013) (http://www.google.com/patents/US20130295512) reported excess heat in alternating nanolayers, eg. Ni / Ti, Ni / Ag (with the addition of interlayer nanoparticles) when subjected, in the electrolysis, to rapid variations in voltage at the extremes

Typology of nanostructures

We will test mixtures of nanoparticles, even at different granulometric composition, materials (fine dust, threads,grains) superficially nanostructured, porous foams, dendritic structures, sintered ceramic-metal , alternating nanolayers, nano depositions on inert support, industrial catalysts for the hydrogenation with addition of cations such as electron donors.

It is here shown a case study in which the preparation of the reactant material occurs in the same reaction apparatus:

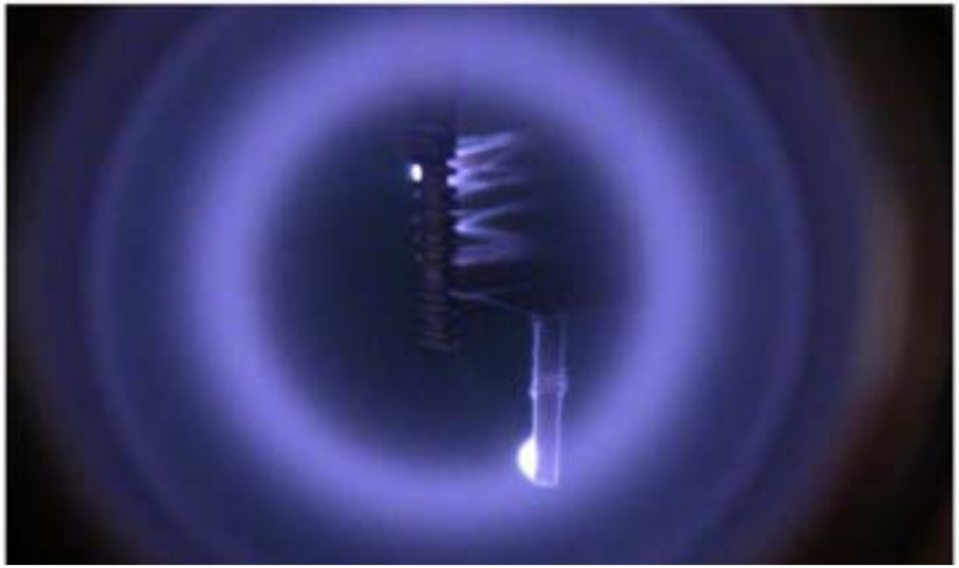
in the Iorio-Cirillo cell, the monolithic cathode is activated after a conditioning in plasma, during which surface defects are developed (http://www.progettomeg.it/all/relazione10.04.pdf)

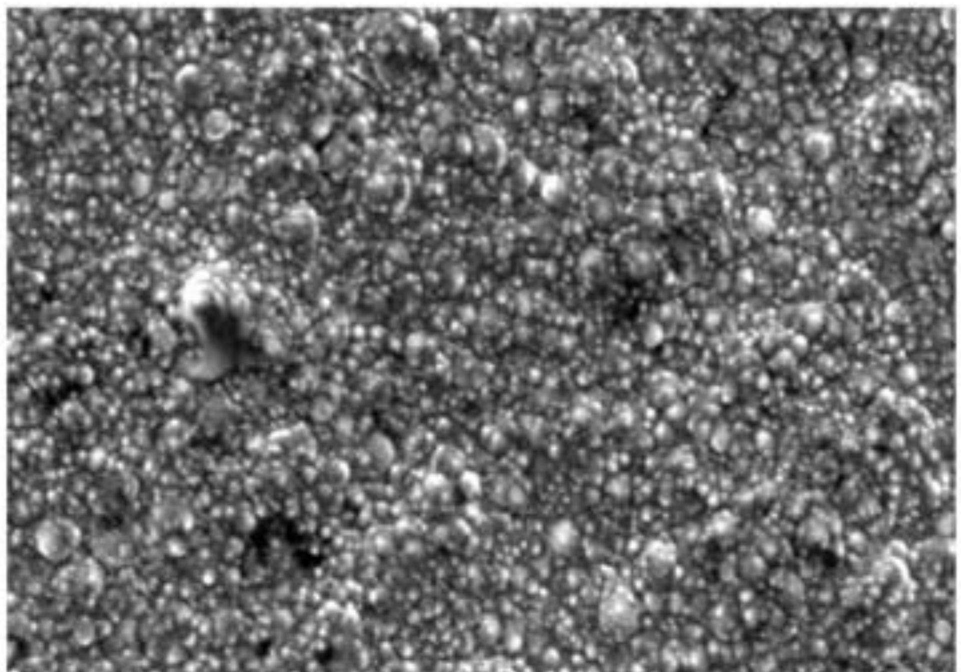


Even during the trial at “L. Pirelli” Instruction Institute it was found that cathodes "used" showed effects more showy, as confirmed independently by P. Clauzon et al. (http://jlnlabs.online.fr/cfr/nfrcnam/NFR_CNAM.pdf)

In the recent patent US Navy US8419919 (https://www.google.com/patents/US8419919) P.A. Boss reports about the deposition of a layer of porous nanostructured Palladium on Gold

T. Mizuno (http://lenr-canr.org/acrobat/YoshinoHreplicable.pdf) activates a grid of Nickel by discharge plasma that makes nanostructured the surface.





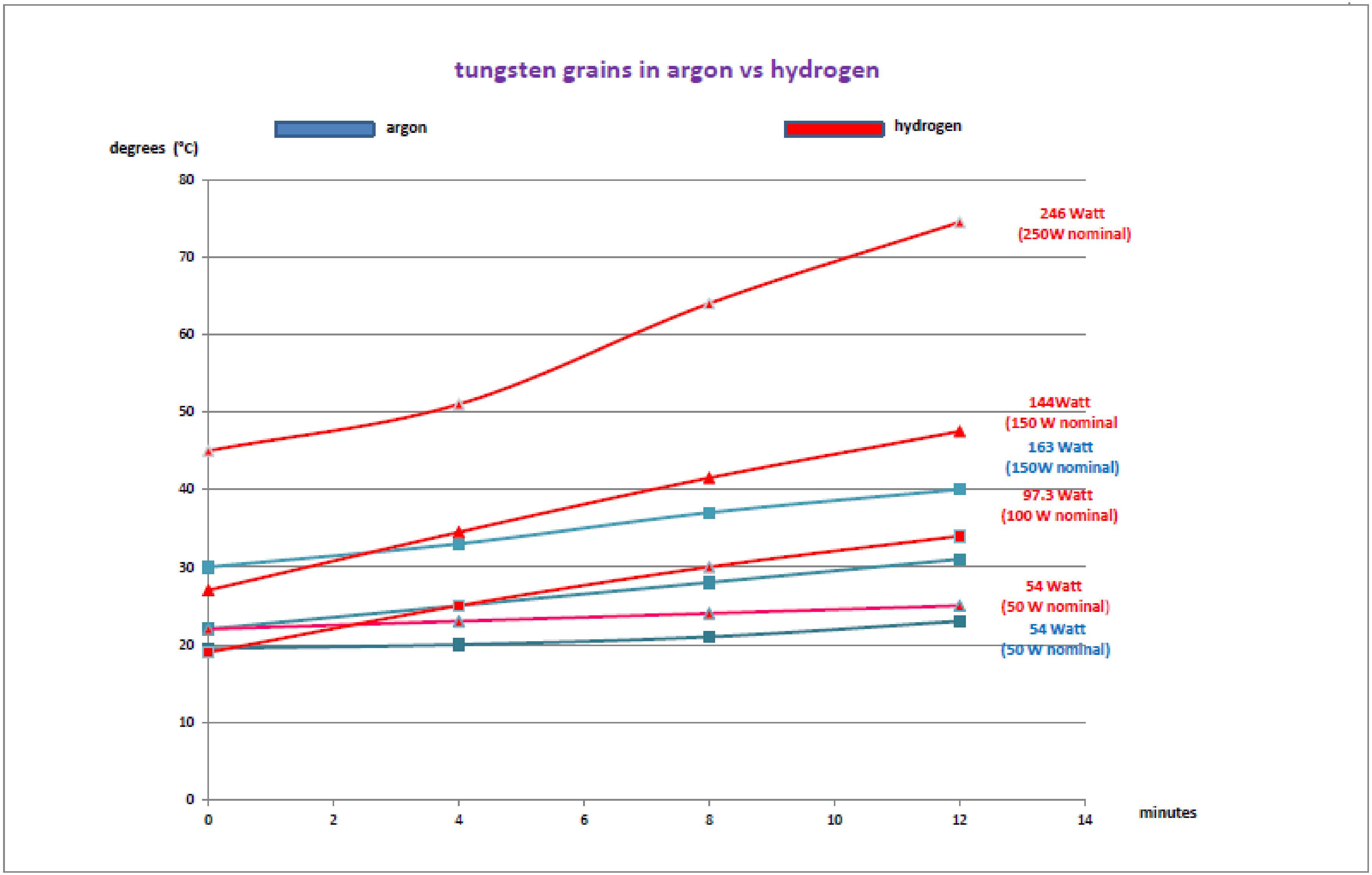
10 micron meter

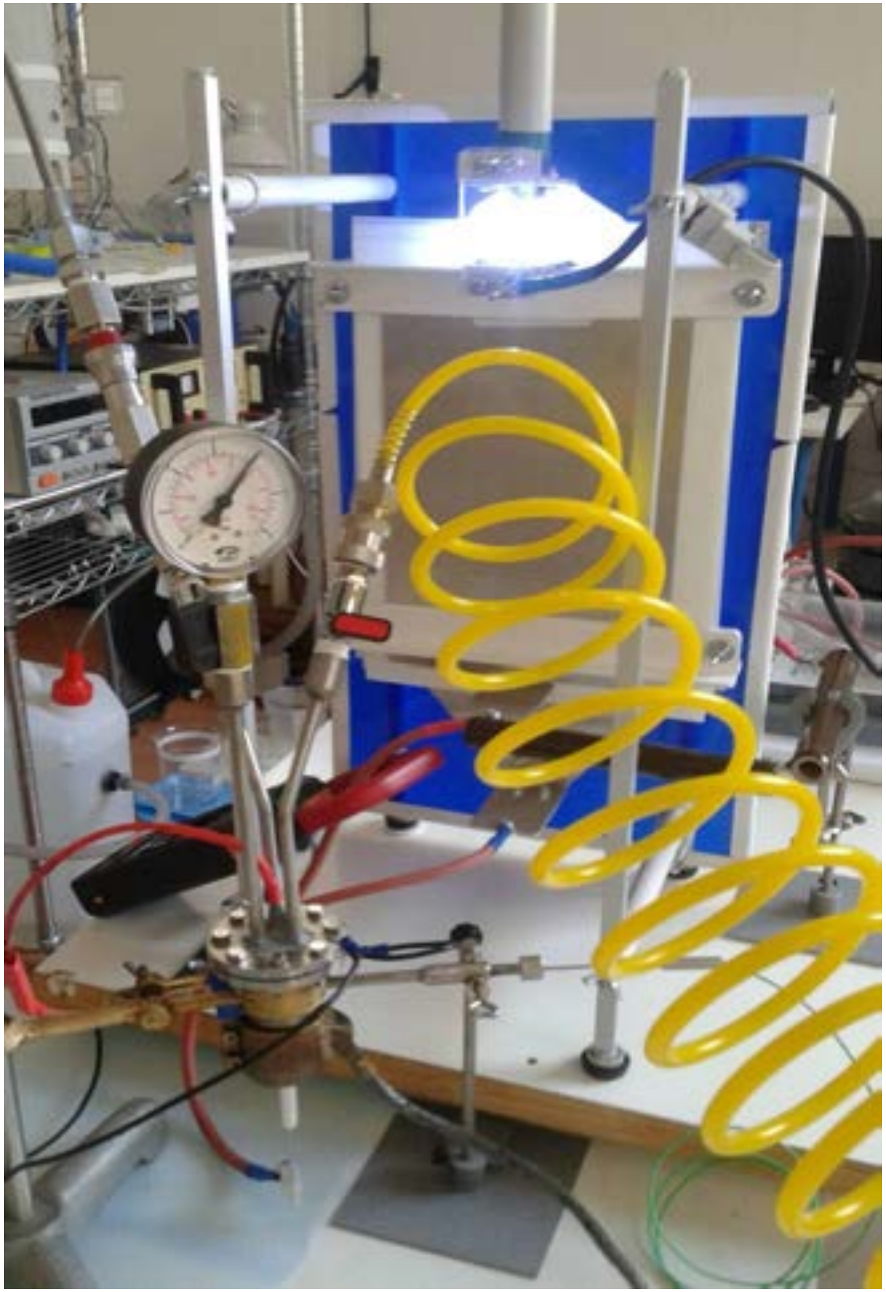
x2000

- In the following first graph are shown the temperature rising when metallic matrices are solicited by pulsed HV electric discharges, in argon vs hydrogen atmosphere; the thermocouple is located in the gas of the chamber.

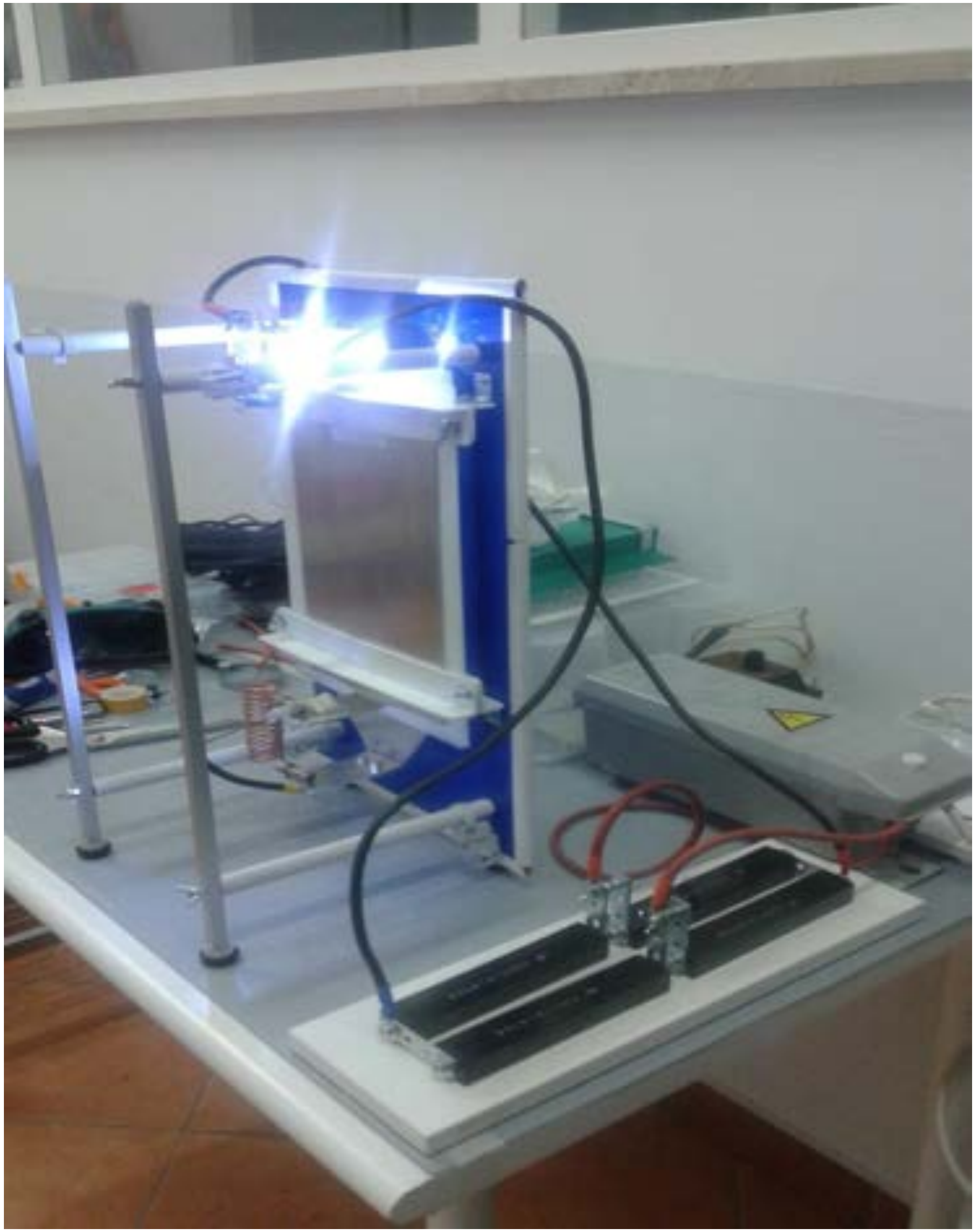
- In the second one, the cathodic thermocouple is not affected by transport phenomena depending on gas pressure and composition.

- In the third one, the behaviour of the mixture Ni - Fe is compared with the behaviour of pure Ni .

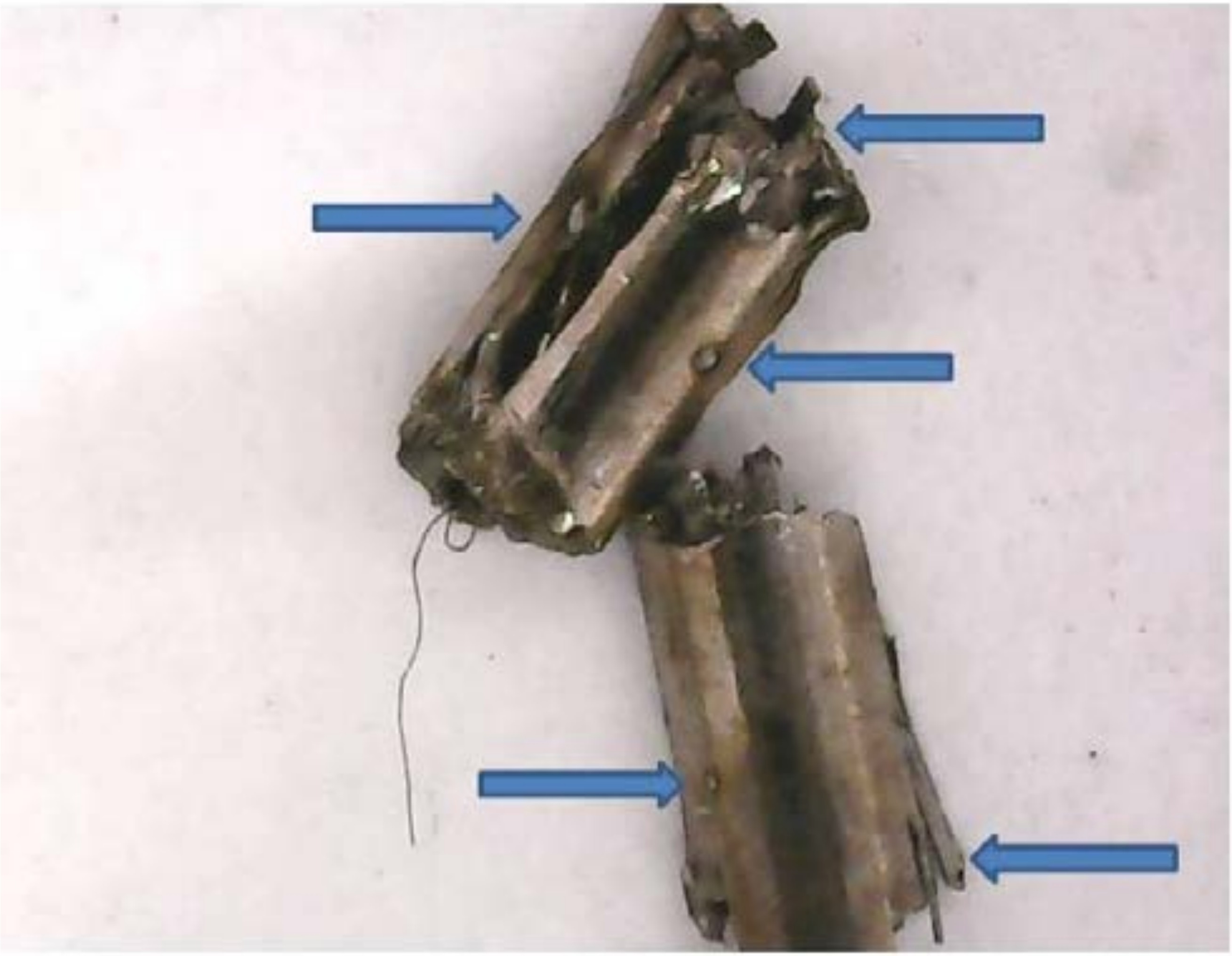

tungsten grains in argon vs hydrogen
argon
hydrogen
degrees (°C)
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
minutes
246 Watt
(250W nominal)
144Watt
(150 W nominal
163 Watt
(150W nominal)
97.3 Watt
(100 W nominal)
54 Watt
(50 W nominal)
54 Watt
(50 W nominal)



Hydrobetatron

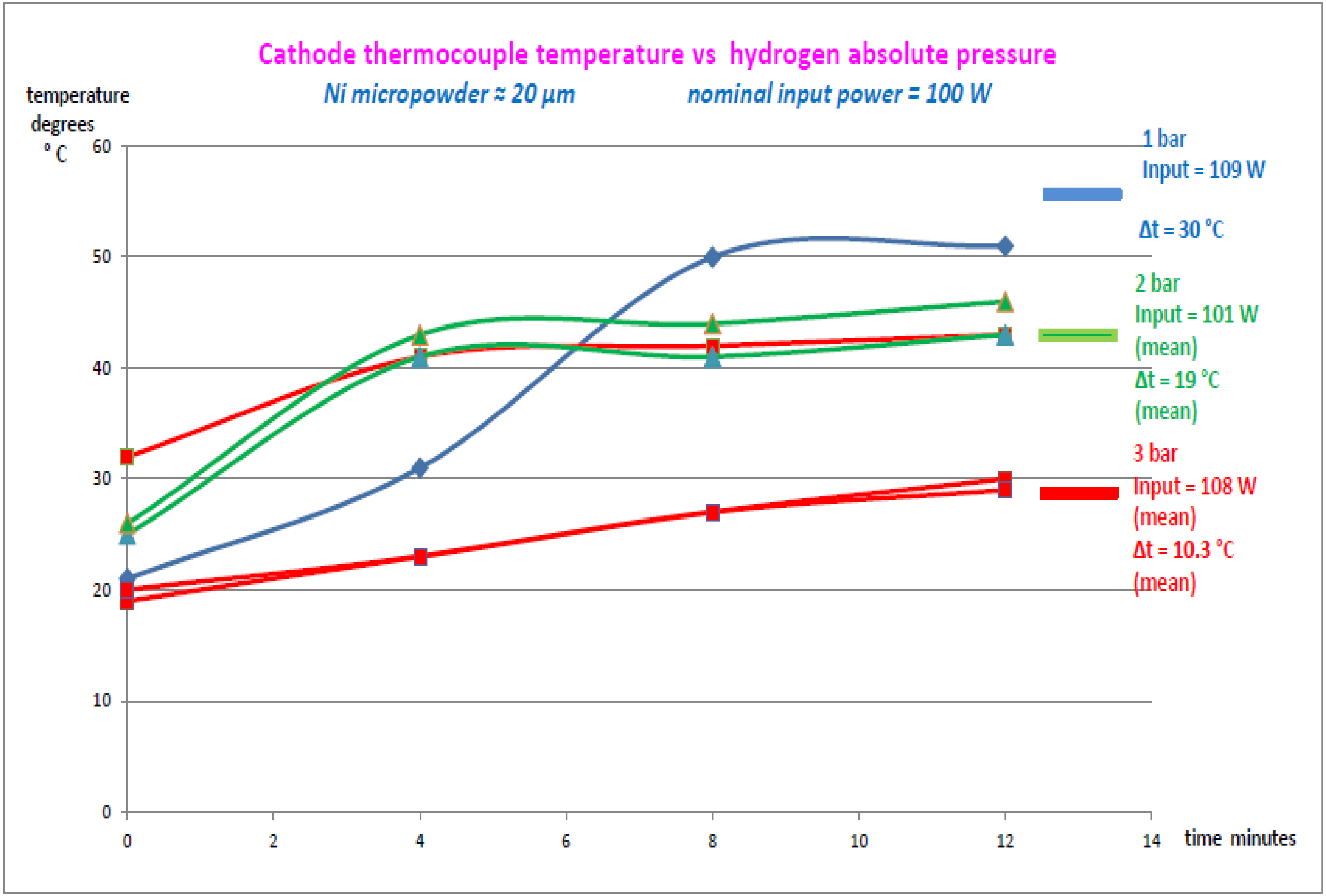


Pulse generator

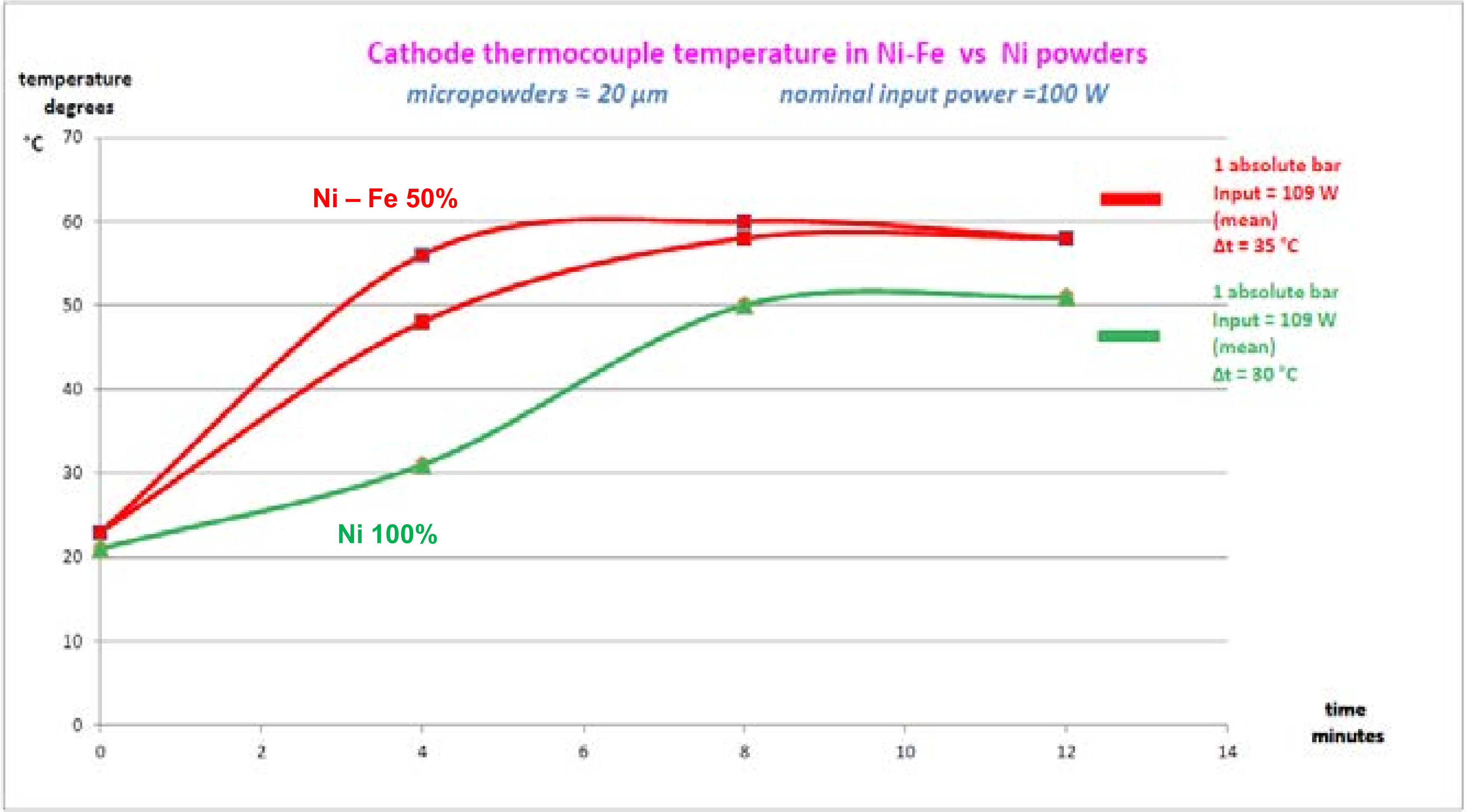


Tungsten cylinders with craters and cracks

Sintered samples from Ni micropowder occurring after reaction



Cathode thermocouple temperature vs hydrogen absolute pressure
Ni micropowder ≈ 20 µm
nominal input power = 100 W
temperature degrees ° C
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
time minutes
1 bar
Input = 109 W
Δt = 30 °C
2 bar
Input = 101 W
(mean)
Δt = 19 °C
(mean)
3 bar
Input = 108 W
(mean)
Δt = 10.3 °C
(mean)



Cathode thermocouple temperature in Ni-Fe vs Ni powders
micropowders ≈ 20 µm
nominal input power =100 W
temperature
degrees
°C
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
time
minutes
Ni – Fe 50%
Ni 100%
1 absolute bar
Input = 109 W
(mean)
Δt = 35 °C
1 absolute bar
Input = 109 W
(mean)
Δt = 30 °C

Ministero dello Sviluppo Economico

Ricevuta di deposito

per

Brevetto per invenzione industriale

Domanda numero: 102015000007937

Data di presentazione: 09/03/2015

Extracted from:

Apparato e metodo per la produzione di energia mediante elettrocompressione pulsata di elementi leggeri in matrici composite ceramico-metalliche nanostrutturate

Apparatus and method for the production of energy by means of pulsed electro-compression of light elements in nanostructured ceramic-metallic composite matrices

A nome: **Associazione Open Power**

Inventori: **Ugo ABUNDO, Alessandro BURGOGNONI, Michele DI LECCE, Paola PIERAVANTI, Salvatore Luciano SAPORITO, Angela VENUTO**

Fig. 1

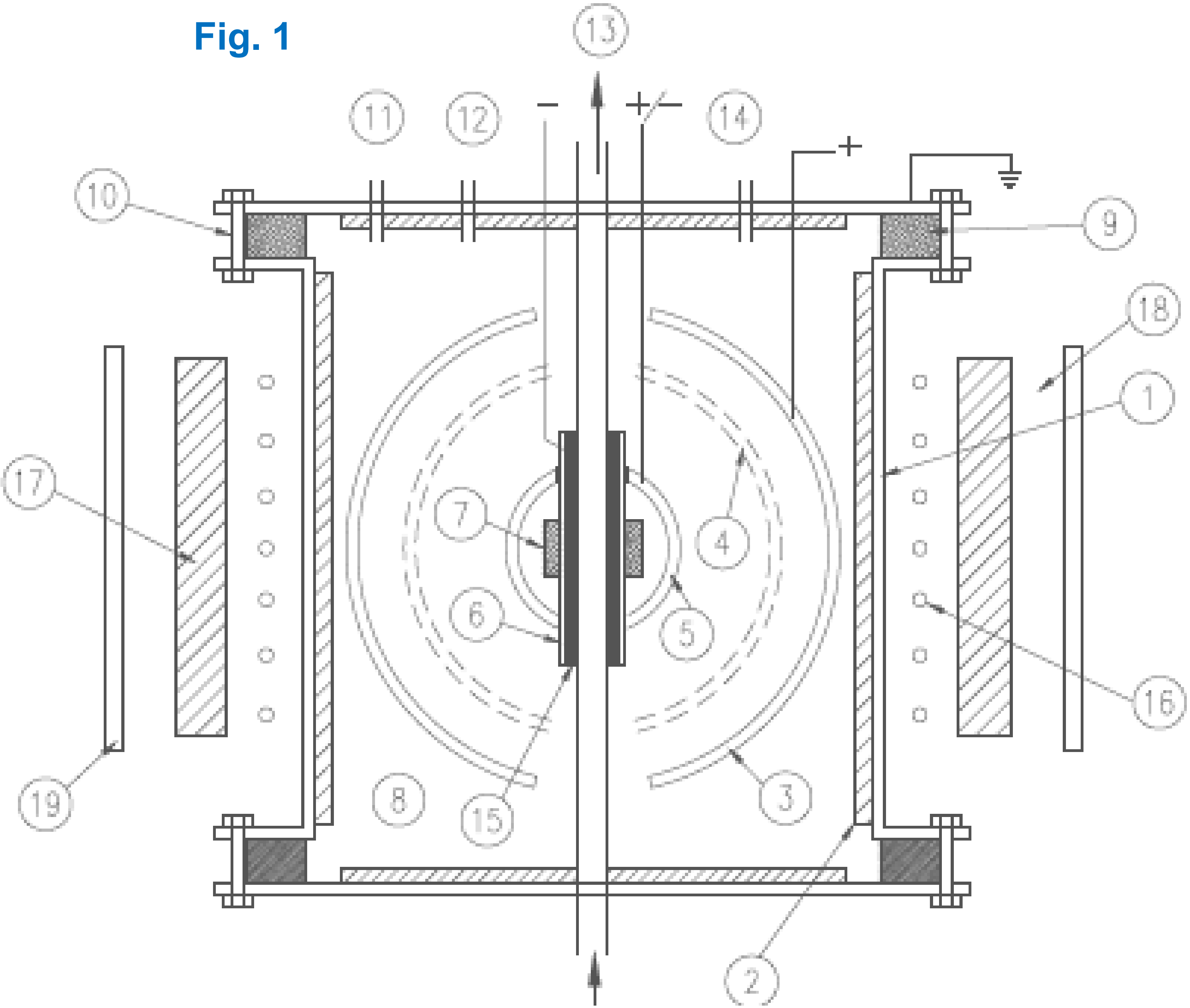


Figure 1 Schematic diagram with three electrodes

The apparatus consists of a container (1) cylindrical, or spherical, preferably made by stainless steel, electrically connected to ground potential, provided internally with a layer (2) insulator, preferably made by Teflon or ceramic; the container, flanged if it is cylindrical, divided into two hemispheres if it is spherical, anyway utilizing gaskets (9) eg. made by silicone or ceramic composite, by tightening bolts eg. made by stainless steel. The container accesses (11), (12) and (14) for the means of control, for the input or the output of fluids, for the electrical connections (by means of insulating elements in respect of the body of the apparatus), for the control and maintenance of the pressure or the degree of vacuum.

The entrances (13) are devolved to the flow of cooling fluids and / or radioactive fluids to be reclaimed. The room can be heated from the outside by means of adjustable electric resistances (16); insulation (17) limits the thermal losses to the outside and surrounding the whole room, peripherally and on the upper and lower faces. The screen (18) (19) is constituted by a gap (18) containing liquid or solid neutron absorbers, preferably aqueous solution of boric acid or boric acid crystals; the cylinder (19), preferably constituted by 5 mm thickness of lead, absorbs secondary radiation produced from the neutron absorption of boron.
An anode (3) preferably semi-spherical or cylindrical stainless steel (continuous or grid) is concentric to a control electrode (5) preferably a grid of tungsten or stainless steel pipe of small cross section internally carrying a coolant, fashioned like a geographic map grid spherical or cylindrical. A double sphere (4) or double cylinder mesh preferably of tungsten or stainless steel ensures the radial direction of the ions.

The tube (13), for example in metal-reinforced ceramic material, is separated from the electrical contact with the tube (6) by a tube of ceramic insulation (15), cemented together with glue ceramic-metal for high temperature. The target (7), constituted by the reactant material, can be constituted by self-sustaining composite material on the tube (6), the cathode, with which maintains electrical contact, or unbundled material contained in a capsule in two cylindrical surfaces, made by material permeable to ions of isotopes hydrogen, preferably niobium, or vanadium, or titanium, also in electric contact with the cathode (6). In the case of spherical geometry, this, in the vicinity of the vertical axis, for a total angular aperture of about 40 degrees, gradually turns into cylindrical symmetry to agree with the tubing placed in the axial position. Typical dimensions of example, but not to be considered limiting of the claims, are 15-20 cm for the diameter of the container (1), slightly less than the diameter of the anode (3), 10 cm for the grid (4), 5 cm for the control electrode (5), 2-5 mm for the thickness of the target (7), and 1-3 cm for its axial length, 6-10 mm for the diameter of the tube (6). The room (8) may contain different fluids in different implementations.

By means of non-limiting example with regard to the claims, the chamber contains hydrogen isotopes , alone or in admixture with argon, at an absolute pressure of 2-4 Torr. Between the anode and the cathode, a potential difference of between 10 and 80 KV ensures the ionization of the gas and the acceleration of the positive ions towards the target, with the migration of the same through the target, with a process of compression provided by the radial geometry of the apparatus, and regulated by the potential of the control electrode (5).

The interelectrode voltage can be constant or pulsed, or contain the overlap between a constant basis, and a superimposition impulsive, variables in sign and repetition rates, with the following values preferable but not limitative:

Interelectrode voltages below 20 KV, to shoot the target protons; above 40 KV to form neutrons with which to irradiate the target, from 20 KV to 40 KV for having overlap between the schemes. The stream of particles is adjusted precisely by said voltage.

The room, in accordance with the subsequent Figure 2, may also contain ions of light elements such as lithium and boron, or, according to other implementations, electrolytic solutions, preferably with lower interelectrode voltages . The experimental data indicate that the interelectrode voltage has to be tuned with the pressure that is intended to have in the reaction chamber and the gas composition, together with the distance between the electrodes, in accordance with the Paschen curves. By way of non-limiting example in regard to the claims, in an atmosphere of pure hydrogen at 2 Torr while the voltage of 3.5 KV is preferable to 8 cm distance, at 1 bar and 8 cm distance, the voltage is preferably 80 KV.

The pulses preferably have a width of a few tens of nanoseconds, preferably verses alternating positive and negative, and create current densities, in the powders of the matrix, of tens of thousands of amperes / cm2, owing to "skin effect" in consequence of the high harmonics contained in pulses. Typical values of repetition rates are from 1 Hz to 1 MHz, preferably between 10 KHz and 100 KHz.
As regards the size scale of the apparatus, the same concept can be applied to smaller, with the aim of experimental campaign optimization; it may also be employed a battery of devices, for example the average size indicated, for the production of larger quantities of energy and / or for the reclamation of greater flows of radioactive waste.

Fig.2

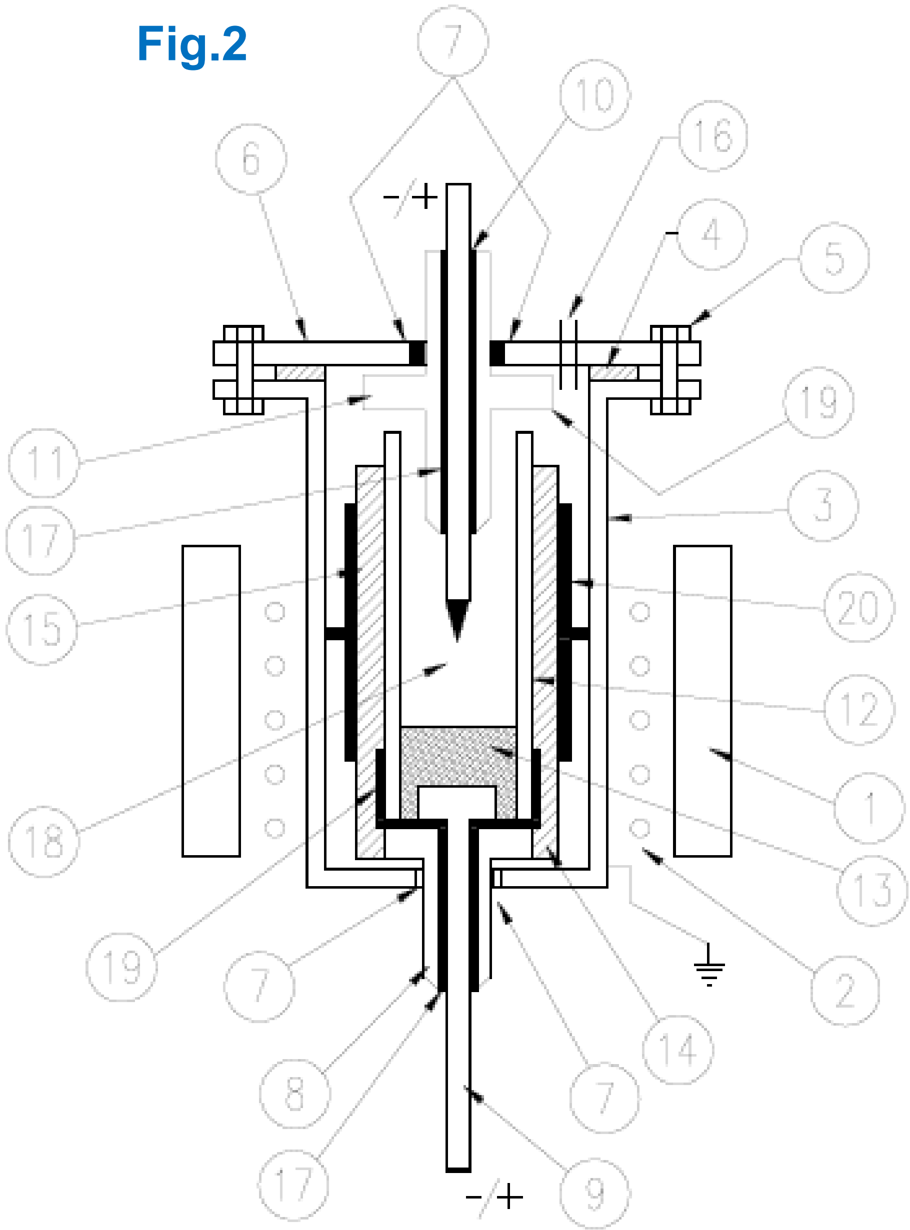


Figure 2 **Schematic linear diagram (simplified, with two electrodes and ground potential)**

The diagram of the apparatus with radial symmetry could be thought as linear, simply imagining a radial elementary portion . Here it is illustrated, for simplicity, only with two electrodes, and ground potential, without this constituting a limitation.

A cylindrical thermal insulation (1) surrounds the adjustable electric heater (2) outside the container (3) preferably made of stainless steel; the gaskets (4) for high temperature seal, by means of steel bolts (5), the flange (6) preferably of stainless steel; the ceramic-metal glue (7) seals the flange to the ceramic element (11) housing the anode (10) preferably made of tungsten, sealed with ceramic-metal glue (17); the reaction chamber (18) contains the gas to be charged through the access (16), at atmospheric pressure, or greater or less.

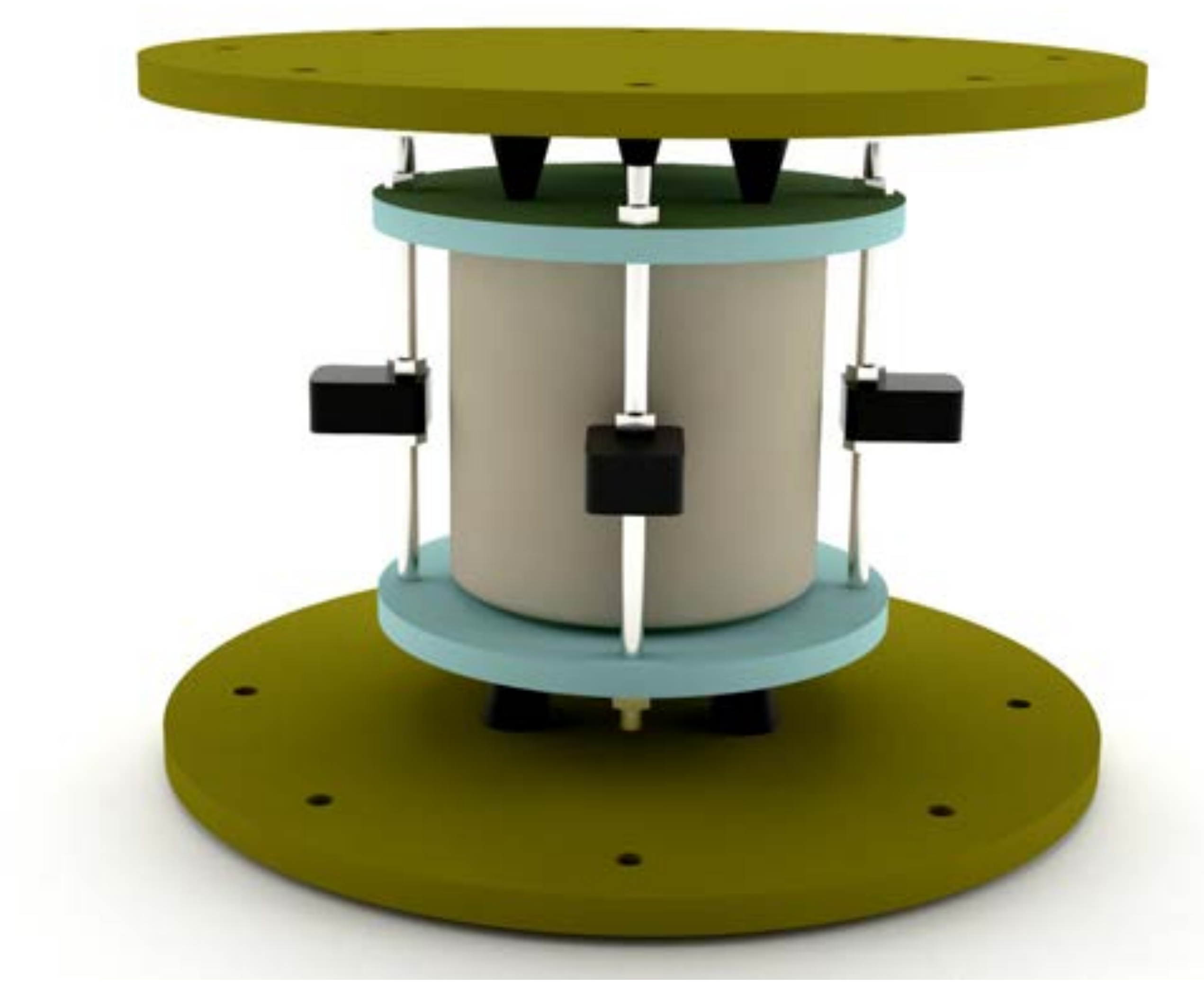
The chamber (15) communicates through the passage (19) with the chamber (18), in which the electric discharge takes place; the insulator (8), ceramic (preferably alumina) insulating the cathode (9) preferably made of tungsten, from the container (3); the conductor pipe (20) is connected, through the container (3), to the ground potential; the ceramic-metal glue (17,7) seals the cathode to the insulator (8) and the insulator to the container (3); the element (13) constitutes the material of the target.

For the dependence between the gas pressure and the interelectrode distance, and the interelectrode potential difference, the same considerations made for the Fig.1 are valid.

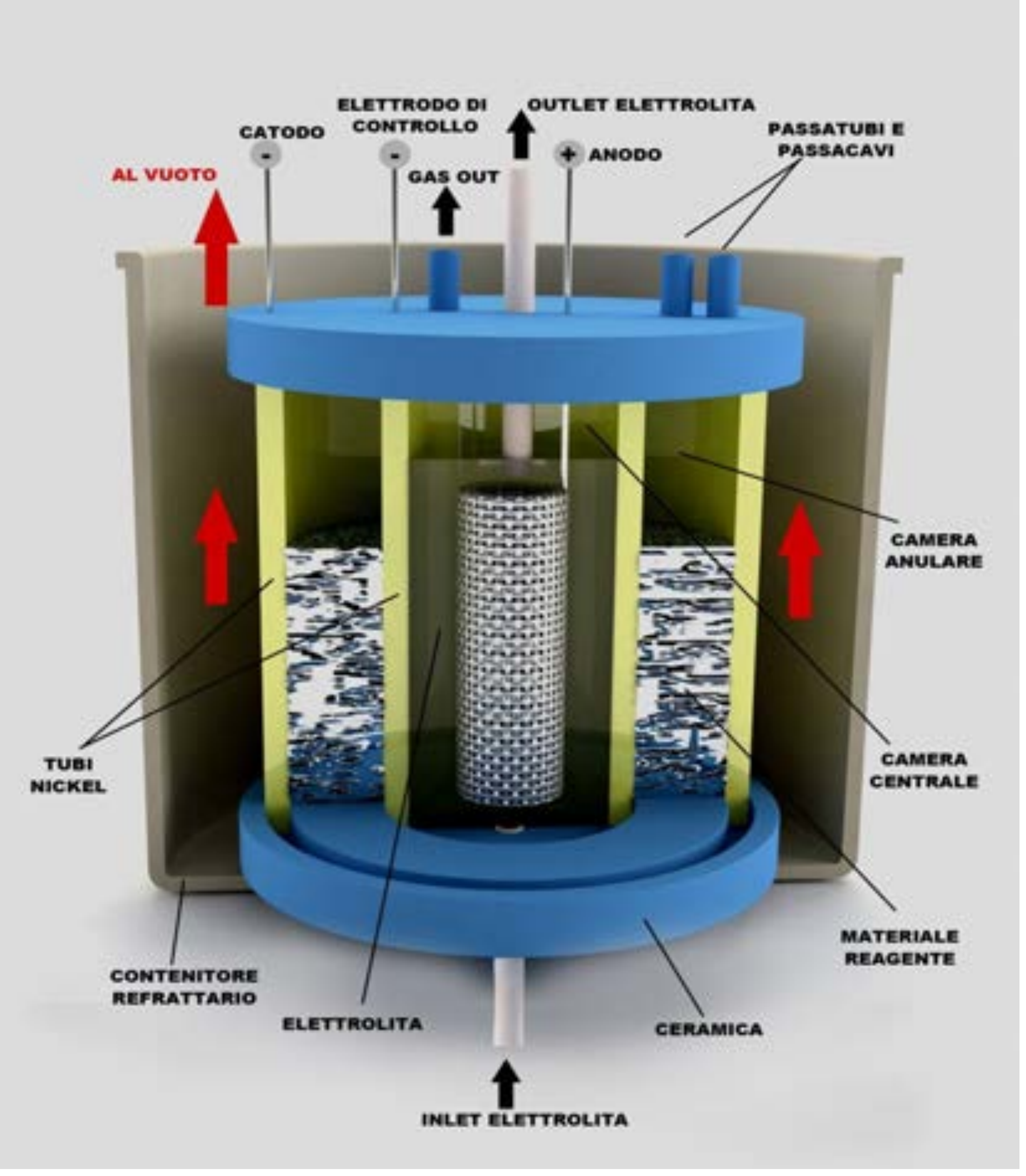
In this version, a different implementation presents functions anodic / cathodic exchanged, placing the very high potential electrode in contact with the target, thus making it reach by the so-called "discharge Shoulders", intense electronic flows capable to develop thermoelectric phenomena; negative ions of hydrogen isotopes, issued by the hydrides present in the target reagents, are compressed with great mobility toward the anode, in synergy with the phenomena of localization of energy.

Hydrobetatron 2.0

Reactor core



Inner chambers



Reactor-calorimeter

CONCLUSIONS

The experimental work about **Nuclear Synthesis** should continue trying to accomplish *highly unlikely configurations*, quickly decaying towards conditions at decreasing information content, sustaining isolated high fluctuation frequencies (B. Ahern's *energy localization*).

After the shown preliminary results, a deeper cooperative research in the drawn direction should appear now fully justified.

At last, the presented field of investigation may provide an enormous wealth of potential behaviours to disclose to understanding.