Updated results on mixtures of powders contained in airtight capsules for activation of LENR anomalies

In what follows we are reporting the results of further tests carried out in the Bareggio's ARGAL laboratory inside the reactor 2 (Photo 1). The reactor 2 consists of a stainless steel container with a volume of about 2 liters inside which , through suitable electrical feedthroughs for vacuum systems, it is possible to feed a heating element wound on a ceramic tube 5 cm long inside which can be placed a metallic capsule containing the powders to be tested. On one side of the tube the temperature of the capsule is monitored with a Pt100 sensor.

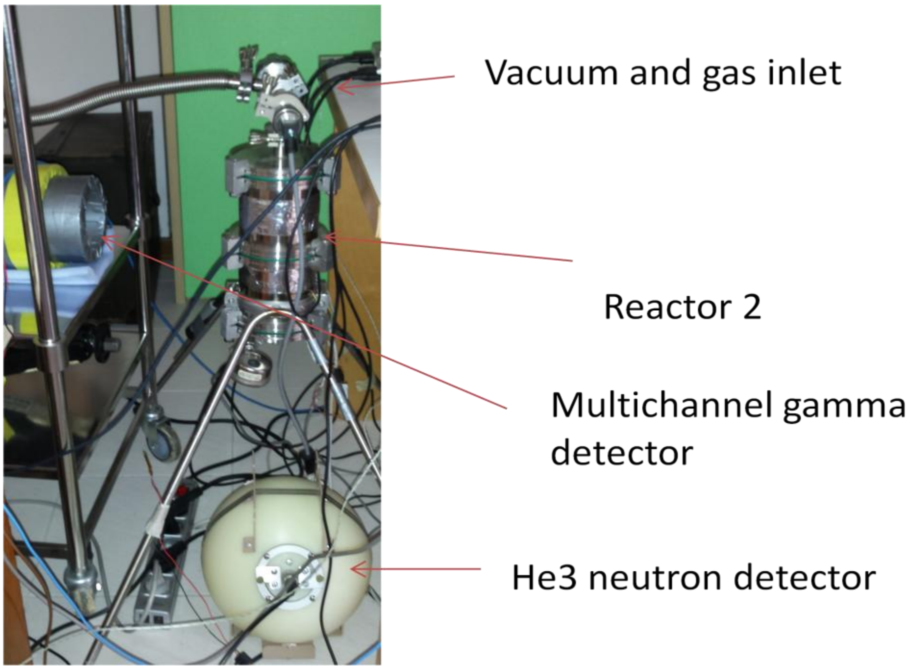


Photo 1: Reactor 2 overview

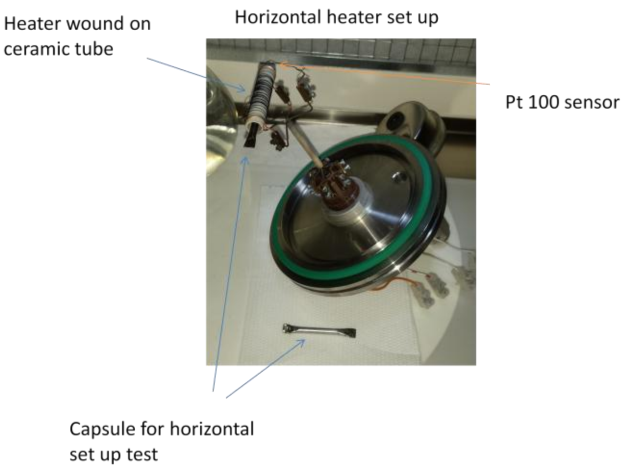
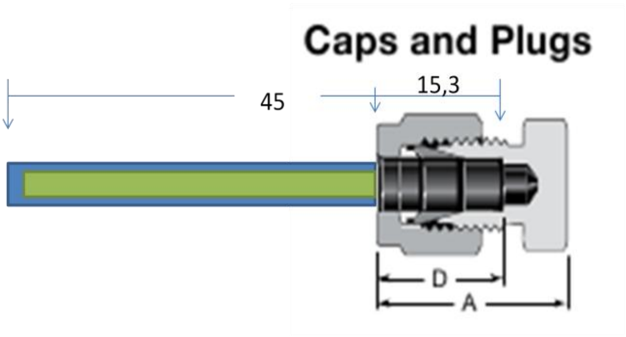


Photo 2: Reactor bottom closure with preliminary tests heater configuration

As for my previous report, all the tests with horizontal heater had sealing problems, so, to overcome these problems, it has been designed a new capsule as shown in the below sketch.



Sketch of a new capsule with a Swagelok cap as sealing.

Vertical heater set up

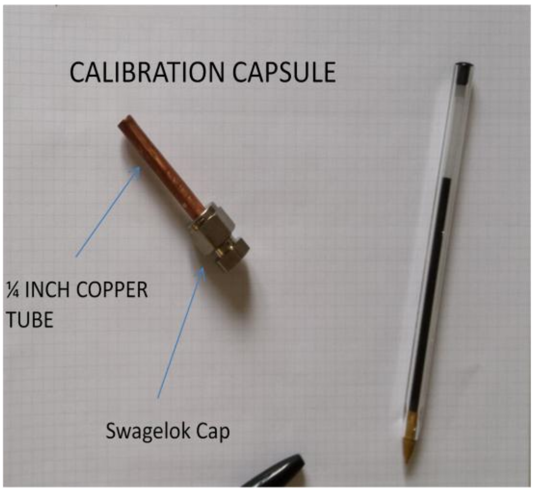


Photo 3: bottom closure with vertical heater

Photo 4: calibration dummy capsule

In order to manage properly the new capsule, the reactor bottom closure has been changed moving the ceramic heater from horizontal to vertical position, cause the Swagelok cap large dimension. The capsule material is all SS (304 and 316) with a tube OD ¼ of inch.

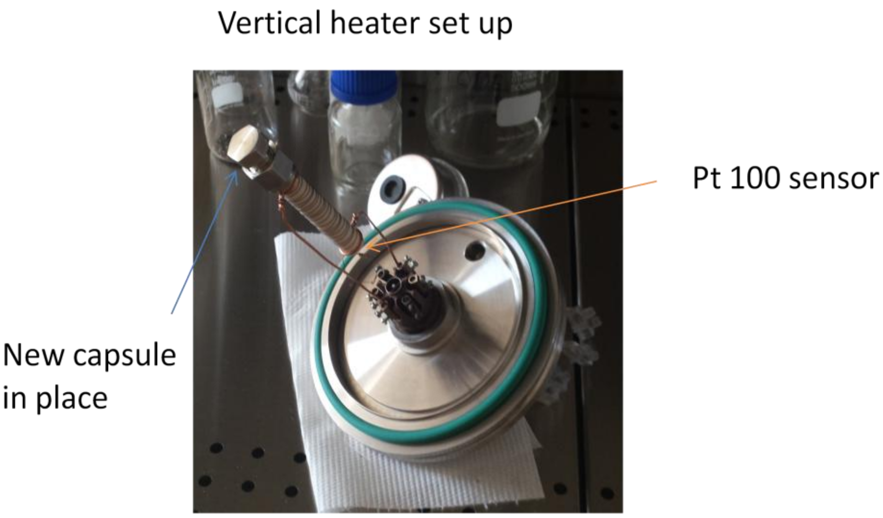


Photo 5: reactor bottom closure with the capsule in place

It may be worth to remember the reactor 2 characteristics.

As the structure of the fairly massive reactor, the thermal resistance Rth towards the environment has a low value that makes the reactor less sensitive to small values of thermal excesses may have been encountered during the test (*Rth = (Tc-Ta) / Pin* or better *delta (Tc-Ta) / delta Pin*). In fact, as will be seen from the tables of the data set forth below, the calculation of the extra power is based precisely on the outside reactor temperature by subtracting the ambient temperature and comparing said value with a calibration curve from a test with an empty capsule. For greater accuracy the temperature outside the reactor is measured by the value of the resistance of a copper wire wound on a good part of the side surface of the reactor, in turn calibrated with reference to a Pt100 on the same outer surface of the reactor. In the table that follow the performed test was conducted with constant power-in mode. All the curves of the graphs have therefore the power parameter input on the horizontal axis, this being the useful parameter for the determination of any excess power produced inside the reactor.

Here below three summary table of the experimental parameters at the end of the calibration and subsequent tests with the SS capsule filled with Ni & Fe micrometric size powder plus Li Al Hydride; all the values were taken at temperature stabilization after any power increase step.

CALIBRATION

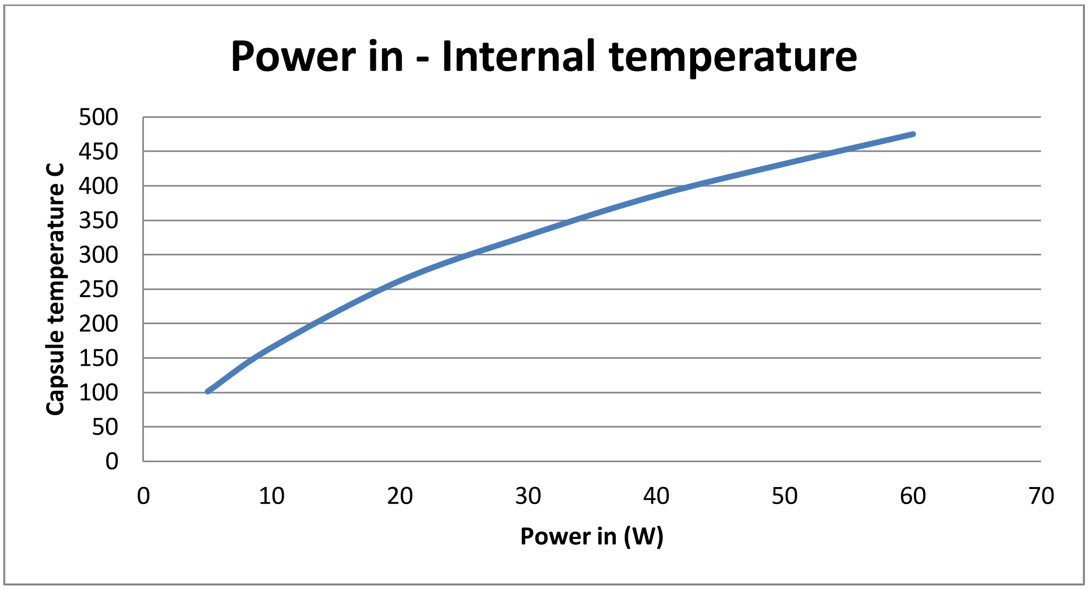
Reactor Pressure	Power in Watt	T c chamber	Ta ambient	Ti internal	Tc-Ta	Rth	Note:	P/Po
100	0							1,00
106	5	35,5	32	100	3,5	0,7	Swagelok	1,05
112	10	42,2	32,7	160	9,5	1,2	cap on ¼ inch	1,11
119	20	52,3	31,5	249	20,8	1,13	copper tube	1,18
124	30	61,2	31,2	317	30	0,92	Po = 100 mbar	1,23
131	40	70,5	31,4	375	39,1	0,91		1,30
141	50	79,83	32	423	47,83	0,873		1,40

TEST WITH SS CAPSULE FILLED WITH Ni, Fe AND LiAlH4 POWDER

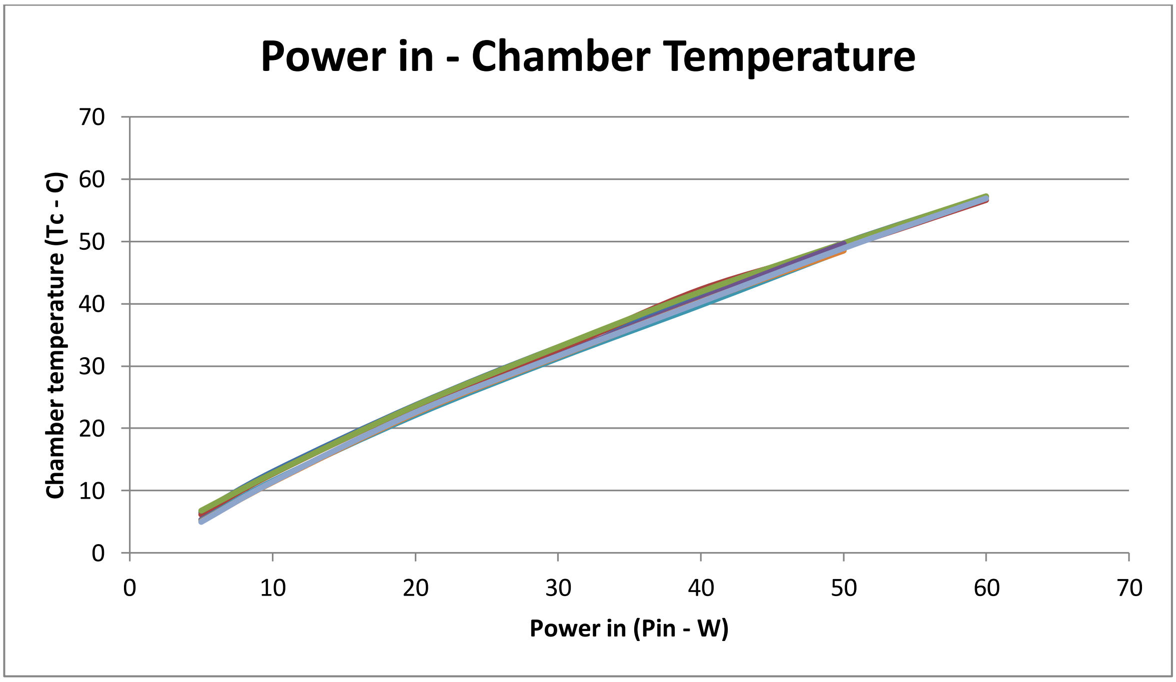
Reactor Pressure	Power in Watt	T c chamber	Ta ambient	Ti internal	Tc-Ta	Rth	Note:	P/Po
100	0							1,00
105	5	34	30,4	87	3,6	0,72	Swagelok	1,04
109	10	40,9	31	133	9,9	1,26	Cap on ¼ inch	1,08
116	20	51,9	31,5	203	20,4	1,05	SS bottom	1,15
122	30	61,3	31,8	255	29,5	0,91	Closed tube	1,21
129	40	70	32	299	38	0,85	Po = 100 mbar	1,28
137	50	78,83	32	339	46,83	0,883		1,36
SECOND CYCLE ON THE SAME CAPSULE STILL INTO THE REACTOR								
102	0							1,00
108	5	34,89	31,54	89,6	3,35	0,67	Swagelok	1,06
113	10	41,72	32,2	135	9,52	1,234	Cap on ¼ inch	1,11
122	20	53,1	32,6	205	20,5	1,098	SS bottom	1,20
129	30	61,7	32	260	29,7	0,92	Closed tube	1,26
136	40	70,5	32	300	38,5	0,88	Po = 102 mbar	1,33
143	50	78,5	31,8	340	46,7	0,82		1,40
NEW CAPSULE WITH Ni POWDER PREVIOUSLY TREATED IN HYDROGEN AT 500 C								
100	0							1,00
105	5	26	21	80	5	1	Swagelok	1,05
110	10	33,1	21,8	130	11,4	1,286	Cap on ¼ inch	1,10
118	20	44,5	22,1	206	22,6	1,115	SS bottom	1,18
125	30	53,3	21,8	270	31,6	0,905	Closed tube	1,25
134	40	61,8	21,6	312	40,3	0,867	Po = 100 mbar	1,34
150	50	70,26	21,4	353	48,9	0,863	Ni plus LiAlH4	1,50
175	60	78,53	21,7	383	56,9	0,801	1.5 gr 10/1 ratio	1,75

All the above tables have in the first column the pressure in the reactor in mbar, in the second column the power expressed in Watt (Pin), in the third column the temperature Tc of the chamber in degrees centigrade, in the fourth column, the ambient temperature Ta, in the fifth column the internal temperature Ti, in the sixth column the temperature delta Tc – Ta, in the seventh column the thermal resistance Rth of the reactor and in the last column the normalized pressure in the reactor for a consistent comparison of the curves, given that the starting pressure is not always identical between the various test.

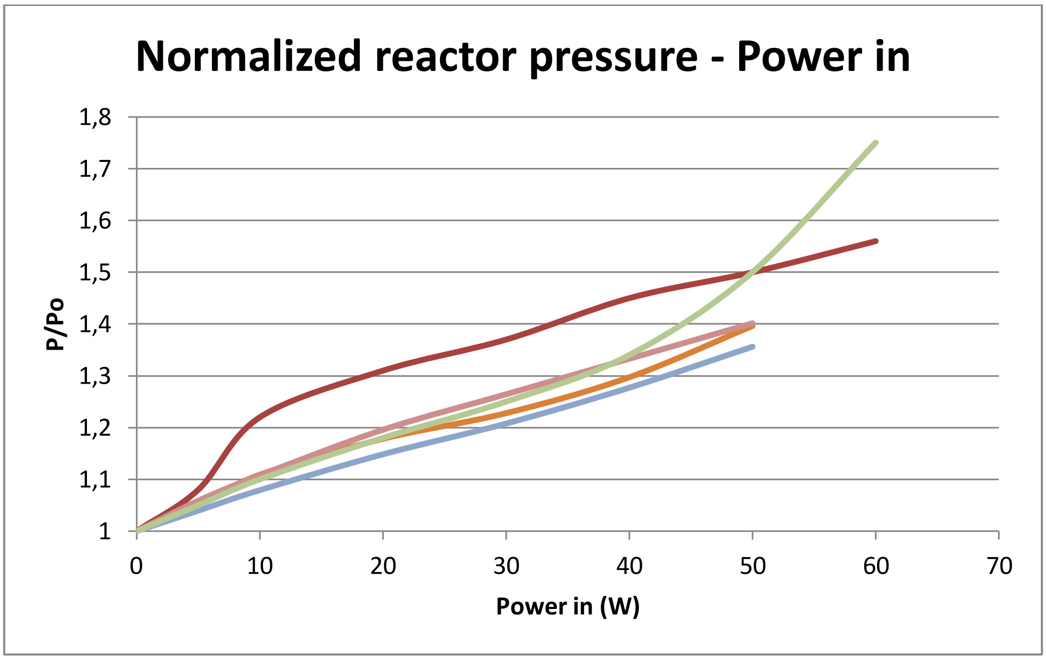
Graphs:



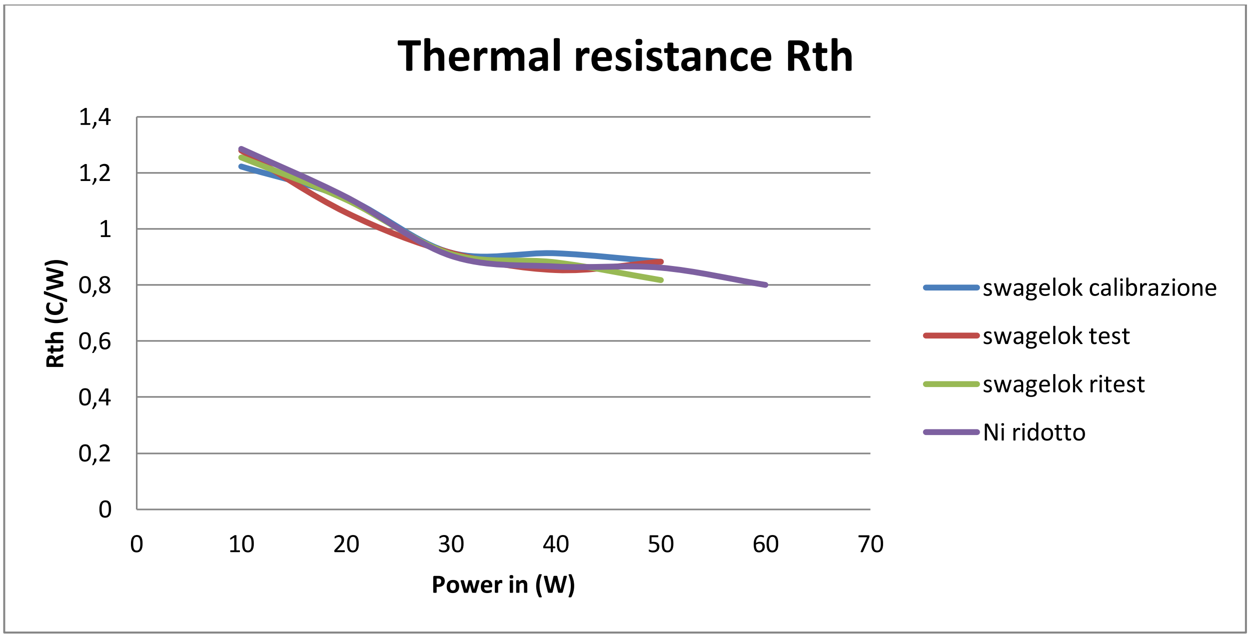
Graph 1. Temperature of a Pt100 inside the calibration copper tube versus the Power-in. The position of the Pt100 during the tests on the SS capsule was at the edge of the heater, so the measured temperature at the same power in is lower than for the calibration.



Graph 2. Temperature of the reactor surface versus the Power-in. The overlay of the curves for different test indicates the good reproducibility of the experiments, but also the absence of anomalous heat generation. At least one curve refers to a calibration test without powder in the capsule. We have two sets of overlapping curves both from tests with the horizontal heater set up and smaller mass capsules and others from the vertical heater set up with one from calibration and the others referring to the Swagelok sealed capsule.



Graph 3. Normalized pressure in the reactor versus Power-in. The red curve is from a test in the horizontal heater set up with the already reported sealing problems. Instead, the new capsule shows good sealing; in fact, the light blue line is the first test with the hydride inside the capsule and shows linear behavior as expected. The brown line is for the second test on the capsule, while the pink line is for the calibration with the copper tube. The light green curve concerns the test with a new capsule containing Ni powder previously treated in H2 at 500 C for 24 hours in order to reduce the Nickel oxide on the particles surface, mixed with LiAlH4 in a ratio 10/1 in weight; total amount 1.3 gr. The rising up of the curve starting from 40 W indicates the lost of good sealing, but the inside pressure could be very high due to the very low free volume into the capsule (estimated over 200 bar).



Graph 4. The Rth behavior does not show any anomaly inside the reactor.

Conclusions and remarks

As it can be seen from the curves trends in the graph (3) showing the pressure in the reactor with respect to the input power, the new capsule, if the free volume inside is large enough, overcomes the sealing problems. With a small free volume, as in the case of 1.3 gr of fuel inside, the sealing is good up to about 400 degrees centigrade; the pressure inside the capsule is estimated over 100 bar.

When we started to prepare these experiments it was our conviction that the role of the hydrogen pressure was important for the thermal anomalies initiation. Now this thought is not so strong as before.

We have still a couple of “minor” issues to underline: the first is about the role of some nitrogen present in the sealed capsule after the powder filling done in the inert atmosphere in a dedicated glove-box; the second is again the possibility of a residual oxide layer on the nickel particles not reduced enough by the hydrogen and temperature during the test; this second issue could limit hydrogen absorption by the metal grains. The last test with pretreated Ni powder was appositely prepared in order to eliminate the incidence of this second issue.

In the final analysis, it would seem that only the temperature and pressure in the presence of hydrogen are not sufficient to trigger the LENR anomalies, but as highlighted by several other experiments that have led to elements transmutation and excess heat, there is the need of some additional ingredient able to select the less probable reactions in a system thermodynamically completely incoherent .

Bareggio, ARGAL lab, 11-10-2016

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