Excess Heat Production During D_2 Diffusion Through Palladium

Attempts to replicate Arata's experiments : Work in progress

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Summary

1 – Discussion and objectives

2 – Experimental set-up

3 – Experiments

4 – Palladium nano powder

5 – Conclusion

Possible experiments capable of demonstrating the reality of Cold Fusion :

1- Particle detection.

2- Transmutation.

3- Large excess heat.

4- Theory.

Neutrons, protons, tritium, helium 3-4, alphas, X-rays :

1- Low level.

2- Sensitive to noise.

3- Difficult to measure.

4- CR39 is an exception, several labs already active.

Observed during electrolysis, plasma discharge or D_2 permeation :

1- Needs sophisticated equipment.

2- Subject to contamination.

3- Low level, therefore hard to convince nay sayers.

Many laboratories have observed excess heat, however the following characteristics are necessary :

1- Large excess heat.

2- Large Coefficient of Performance (P_{out}/P_{in}).

3- Long duration.

Many theories:

1- Too many of them.

2- Which one is valid ?

3- Open the door to critics.

4- We are not theorists.

Arata's Double Cathode system is best suited :

1- Has the three characteristics.

2- Has been reproduced only once by SRI.

3- Gas loading experiment better suited than electrolysis.

Advantages :

1- Good and simple calorimetry.

2- No electrolysis.

3- No obvious temperature limitation

Challenge :

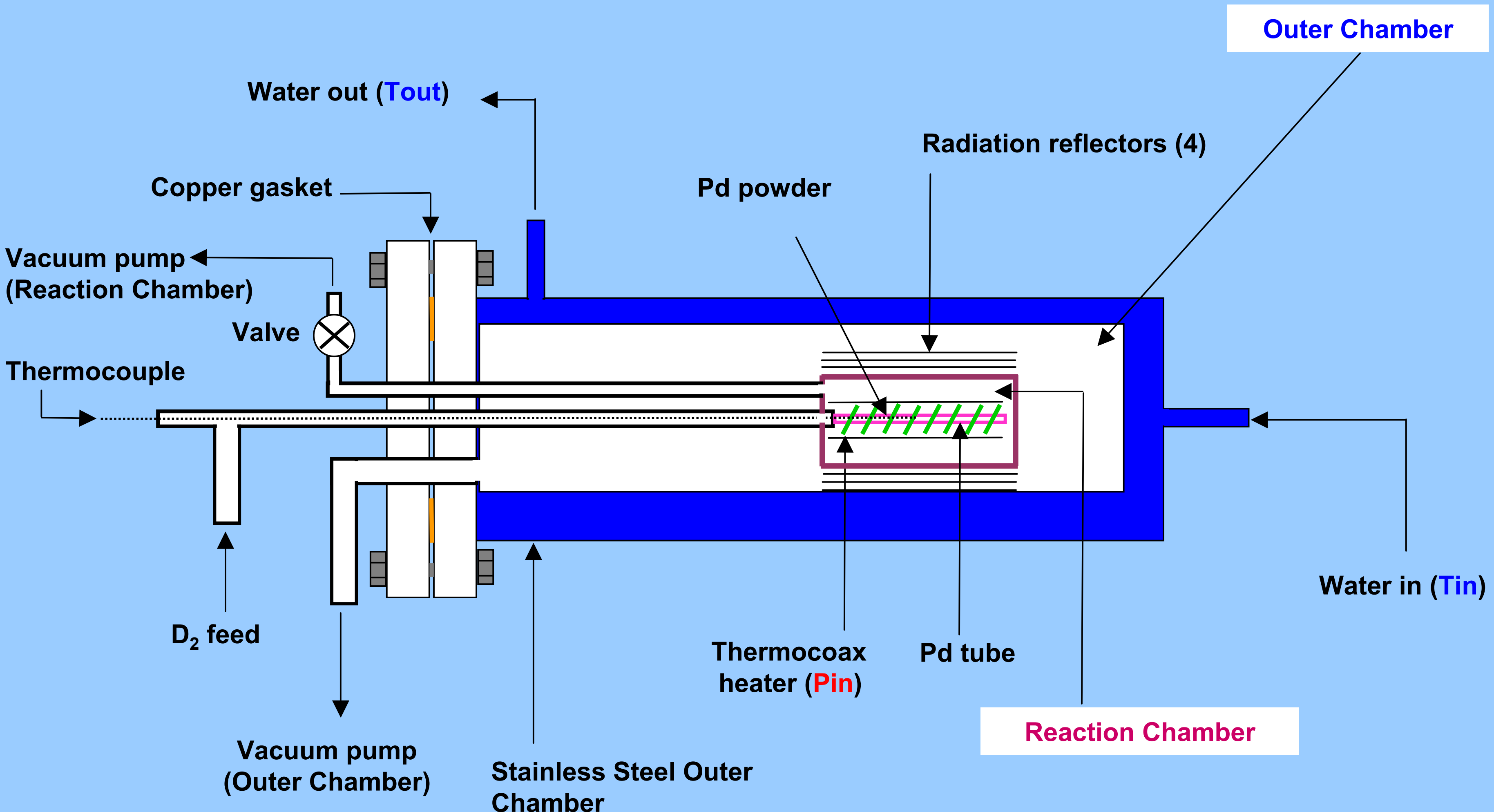
1- Manufacturing of the palladium nano-powder.

Mass flow calorimetry :

1- No calibration needed.

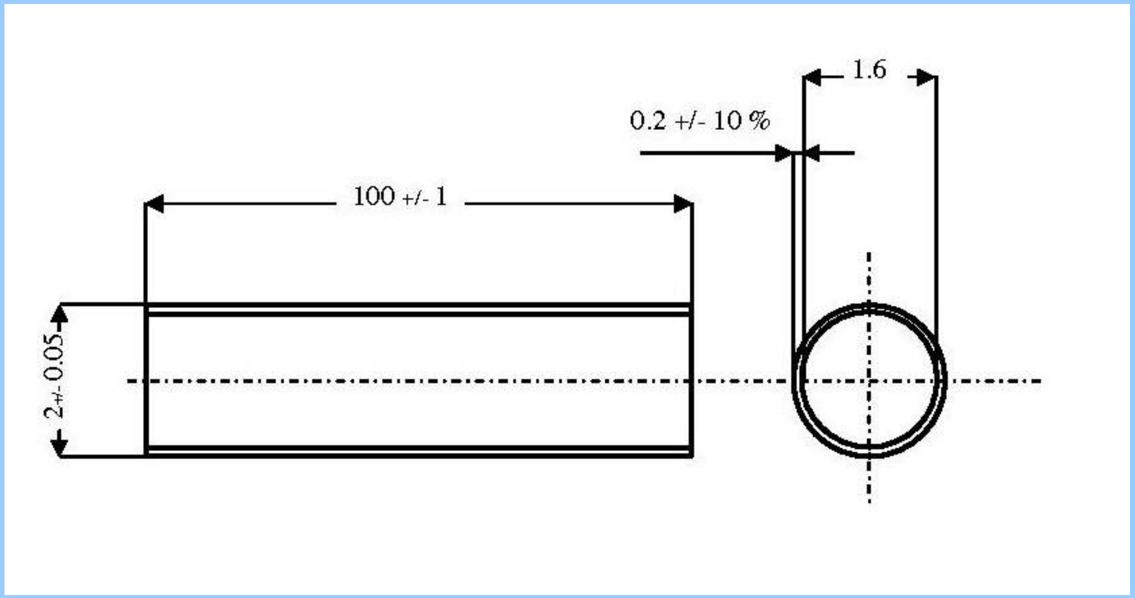
2- Simple to analyze for outsiders.

Biberian-Armanet – Experimental Set-Up



2 - Experimental Set-Up → The Palladium Tube

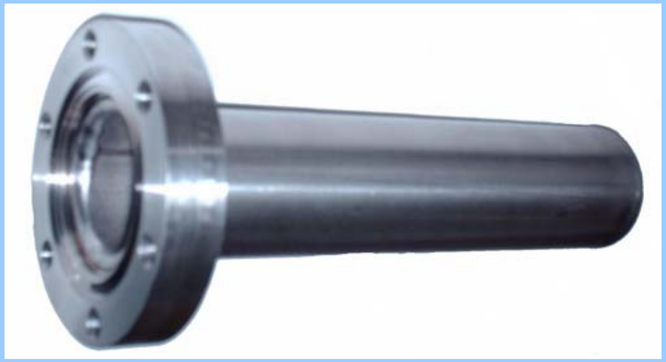
Dimensions



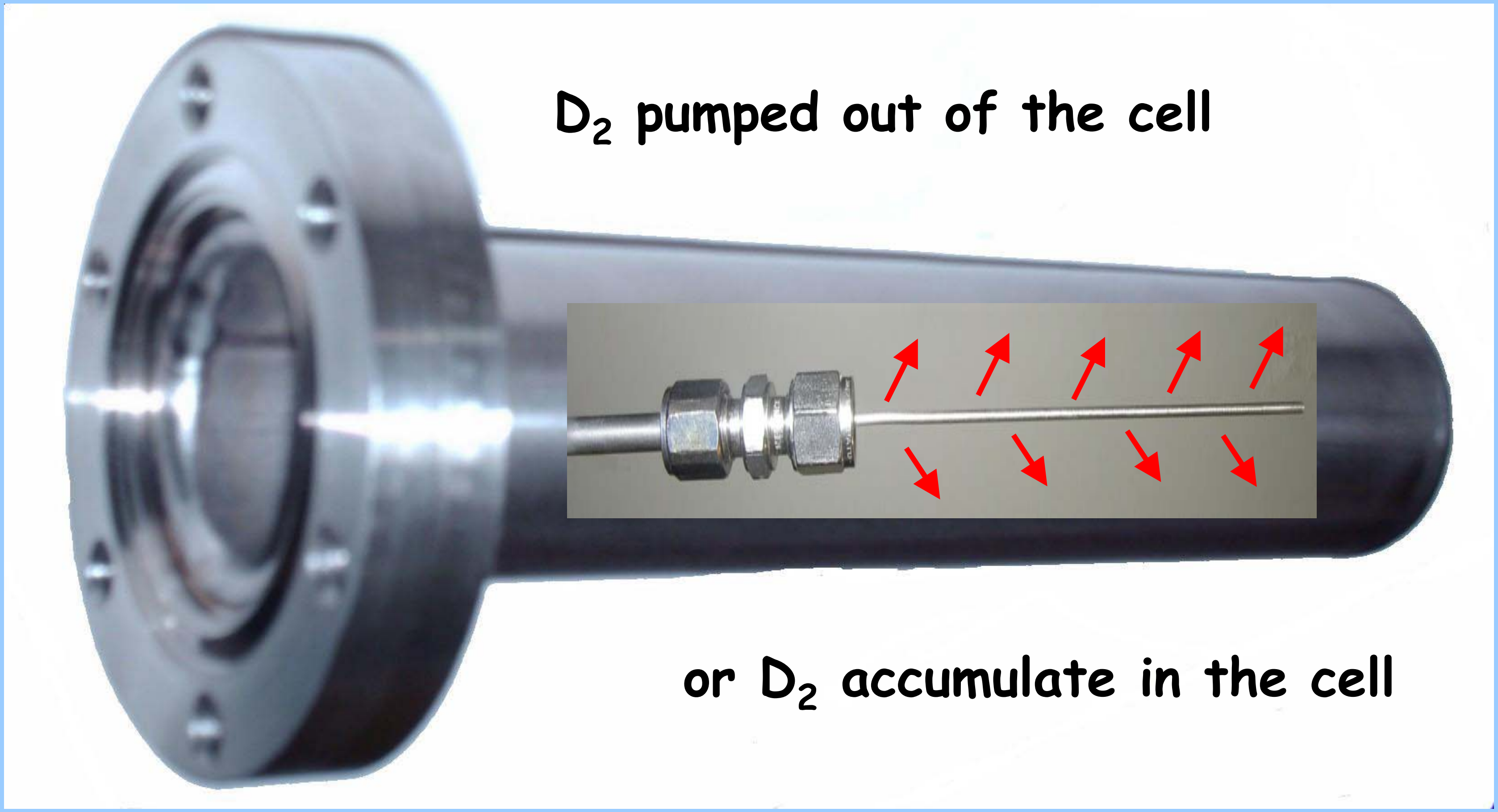
Closed at one end

2 - Experimental Set-Up → **The reaction cell**

Reaction chamber : to decrease heat loss



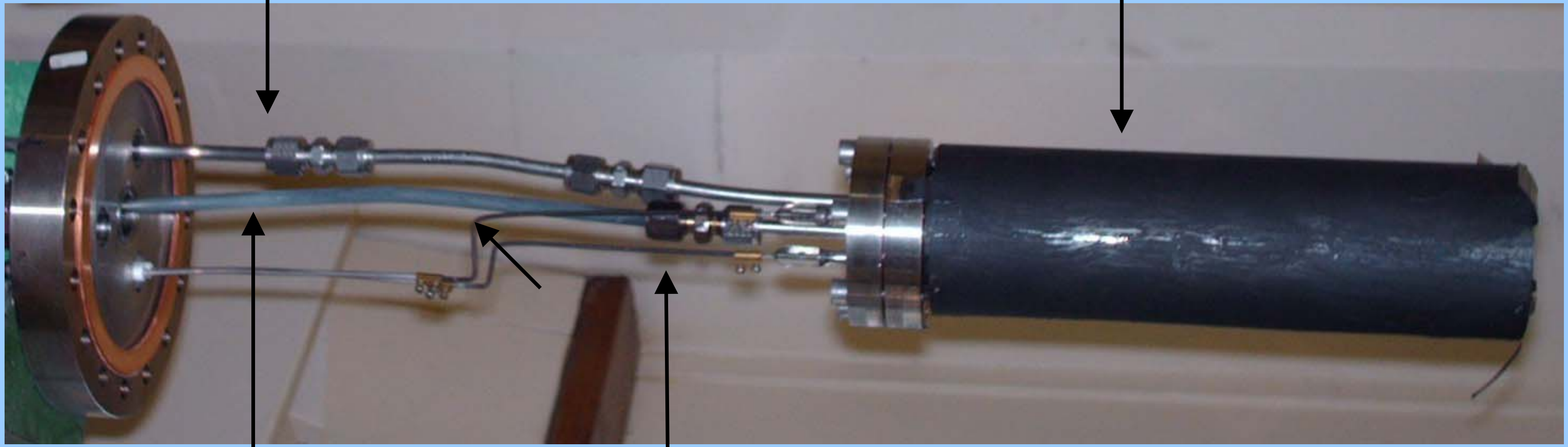
2 - Experimental Set-Up → D_2 diffuses out of the tube



Biberian-Armanet - Reactor Construction

Reaction chamber
D2 vacuum pumping

Reactor core housing
wrapped with thermal
radiation reflectors



D_2 gas tubing

Electric wires

2 – Experimental Set-Up → **Overview**

* **Mass flow : 180 ml/min**

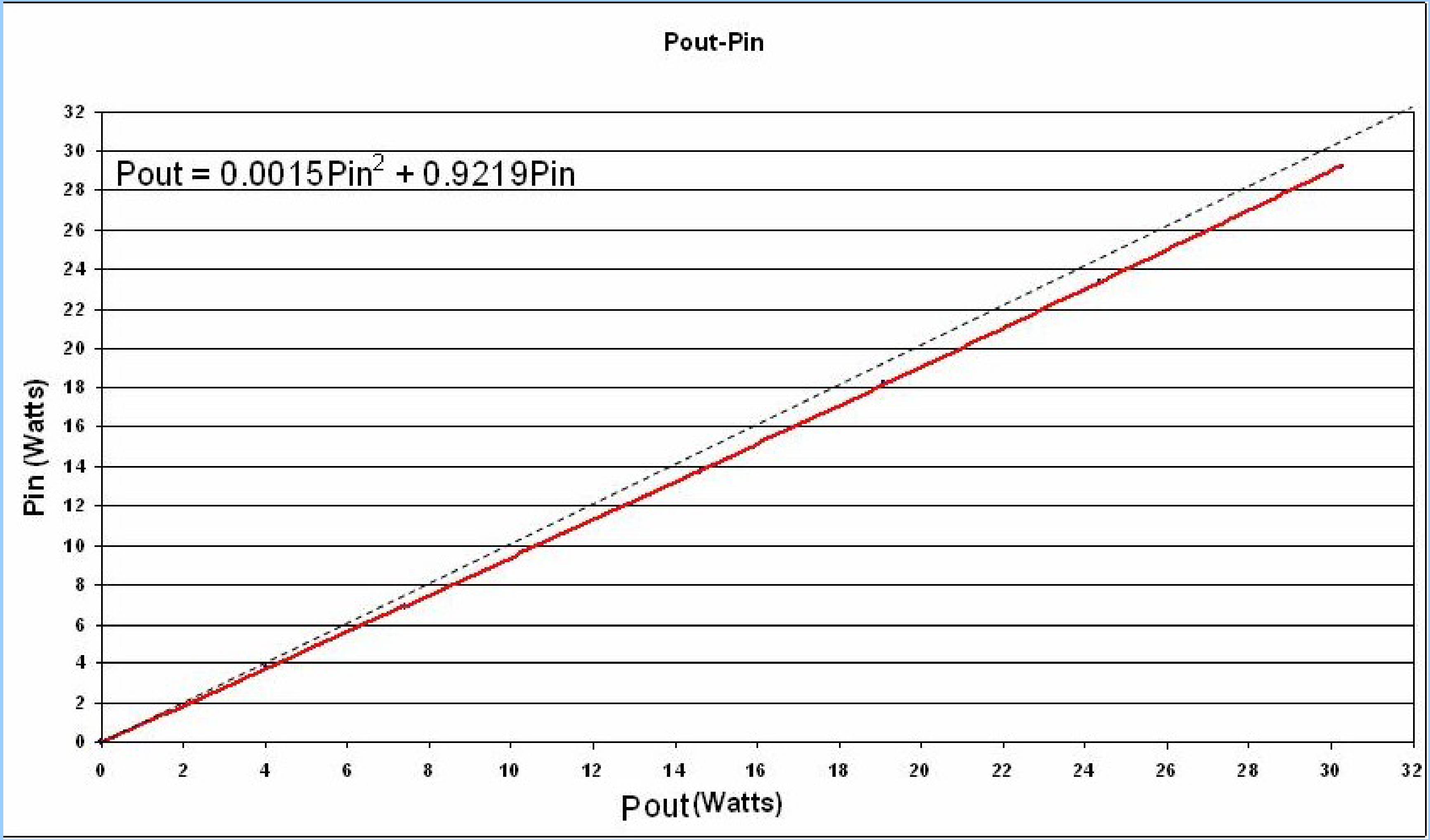
* **Water temperature :30°C**

* **Temperature measured with thermistors +/- 0.01°C**

* **Yield :93 to 97 %**

* **XSH precision : +/- 0.5 Watts**

2 - Experimental Set-Up → **Pout - Pin Calibration**



Palladium (purity 99.95%), 2mm diameter

Pd/Ag (30/70), 2mm diameter

Conditions :

* **Temperature** (30°C to 300°C (max 550°C))
* **D_2 pressure** (3 to 15 atm)
* **D_2 flowing / D_2 accumulating in reaction chamber**

No Excess Heat

→ Titanium was deposited in situ on the outer surface of the palladium tube.

→ Between the palladium tube and the heater, a titanium foil was placed, and evaporated during heating of the resistor

No Excess Heat

→ **Catalyst : Pd 0.6 % on C** (from Les Case)

→ **inside** a **Pd tube** (78 mg) and **Stainless Steel tube** (1 g)

No Excess Heat

→ **Beads : Cu - Ni/Pd/Ni**

→ **inside : Stainless Steel tube** (1 g)

No Excess Heat

→ **Palladium powder** from Goodfellow **(80-180 nm),**

→ **1.15 g**

→ **Stainless Steel tube 6mm**

No Excess Heat

Pd Tube : oxydized in air ~ 500°C during 2 h (before powder filling)

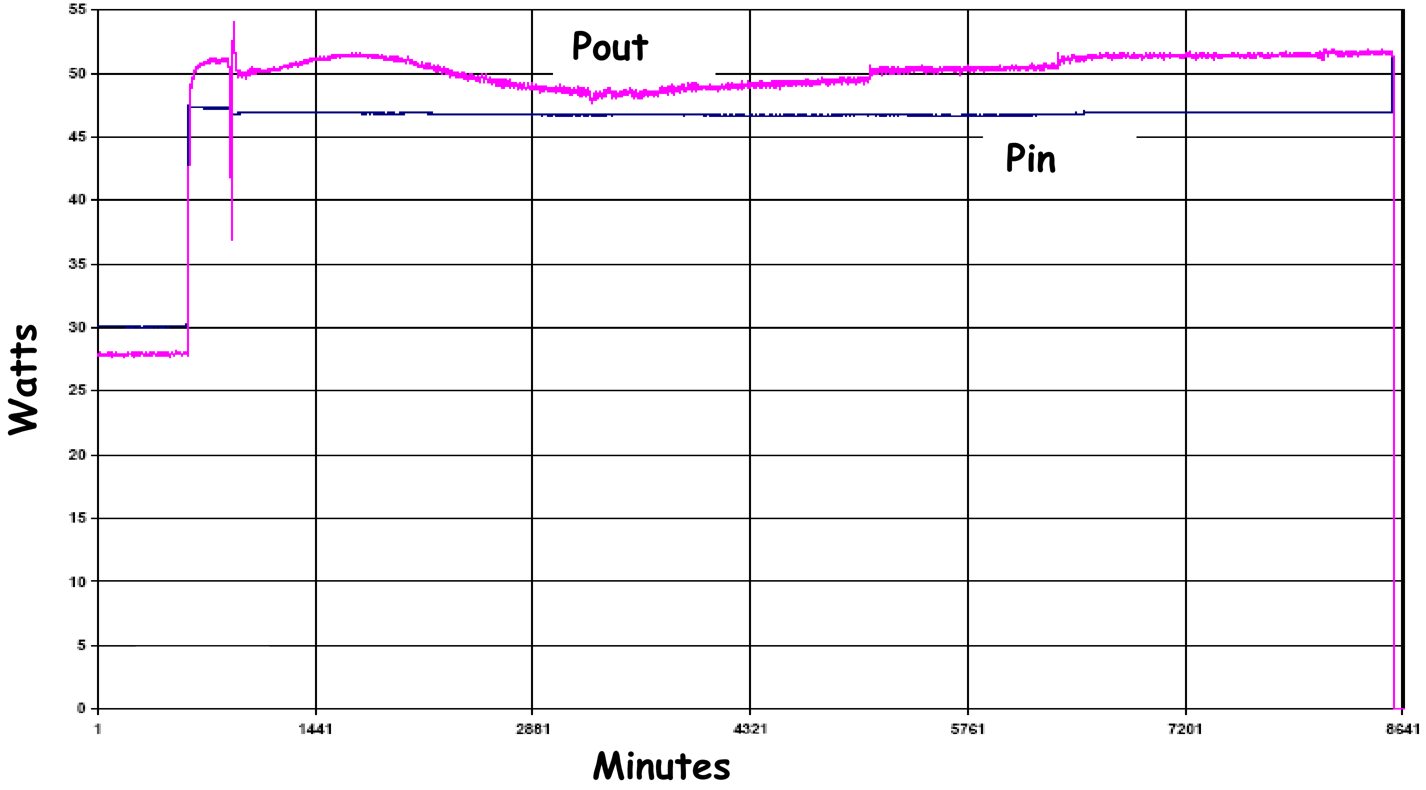
Pd powder : 80 - 180 nm Goodfellow (99.95 %) (~100 mg)

Experimental Conditions during
the Excess Heat :

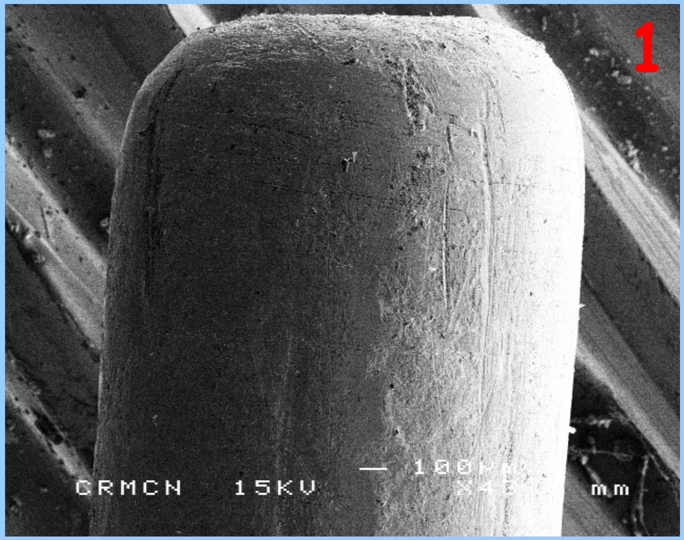
→ **D_2 pressure 9 atm**

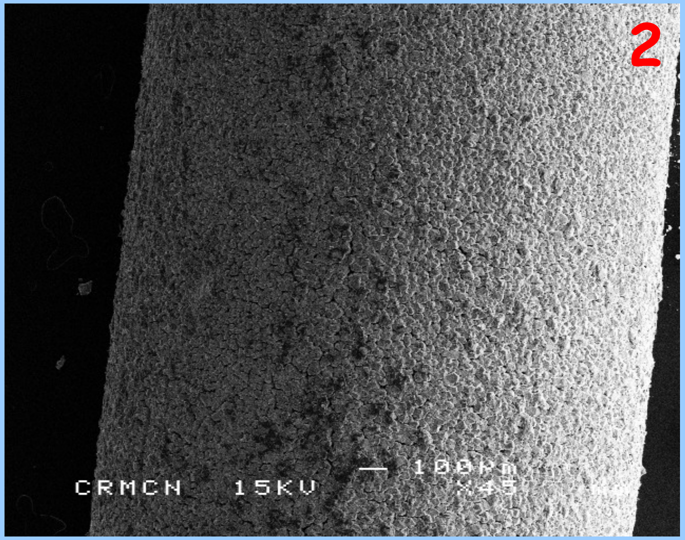
→ **T°C : 80°C**

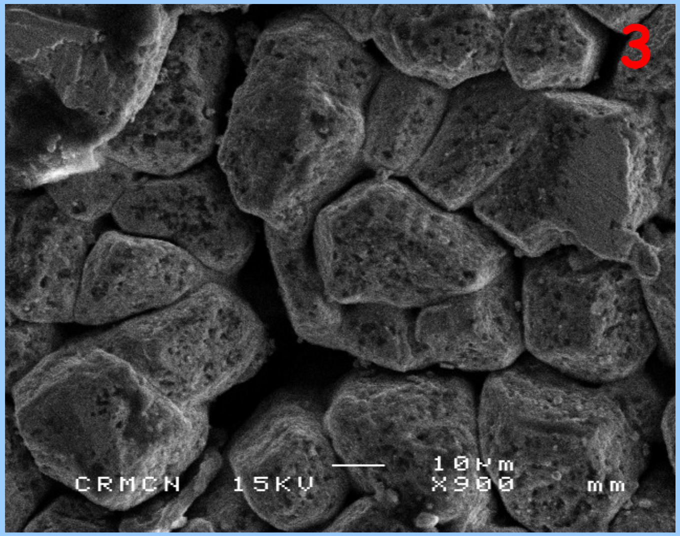
3 - Experiments → Pd tube + Pd powder

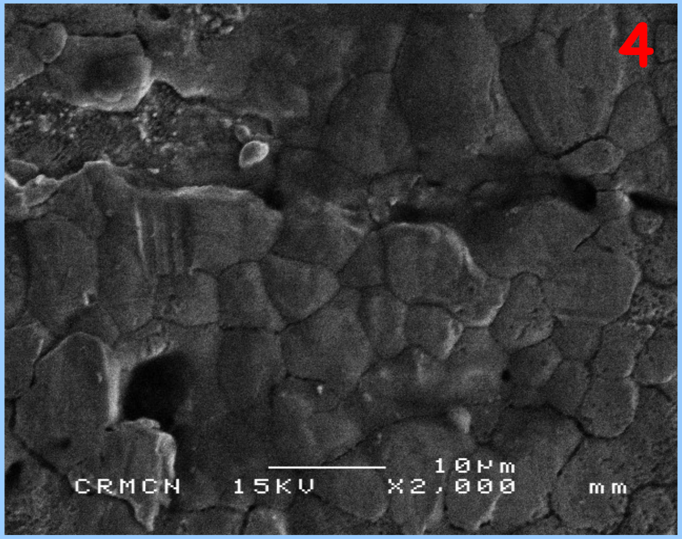


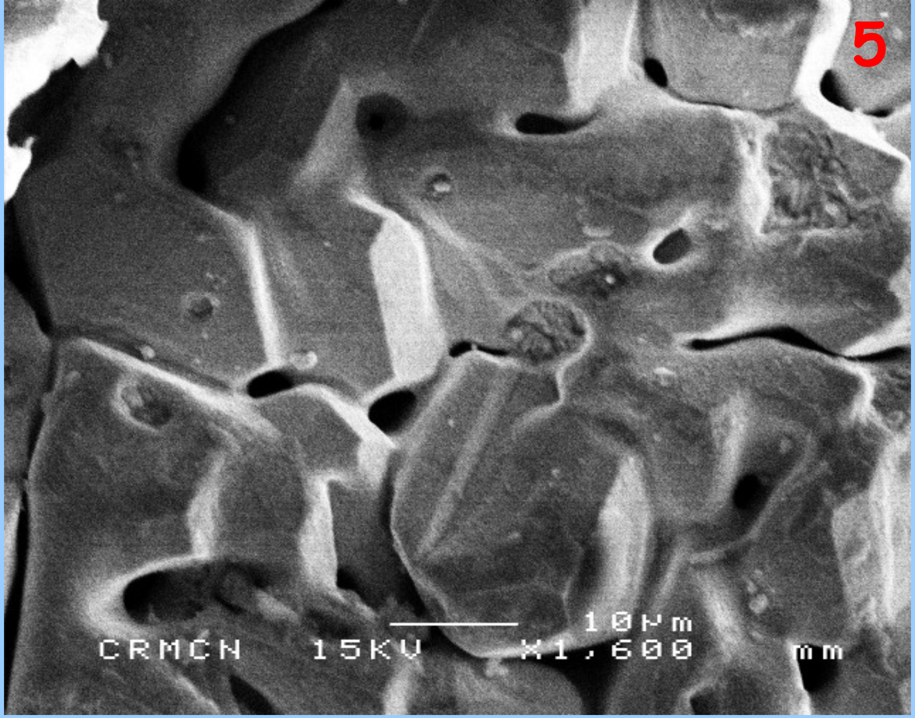
3 - Experiments → Tube after experiment

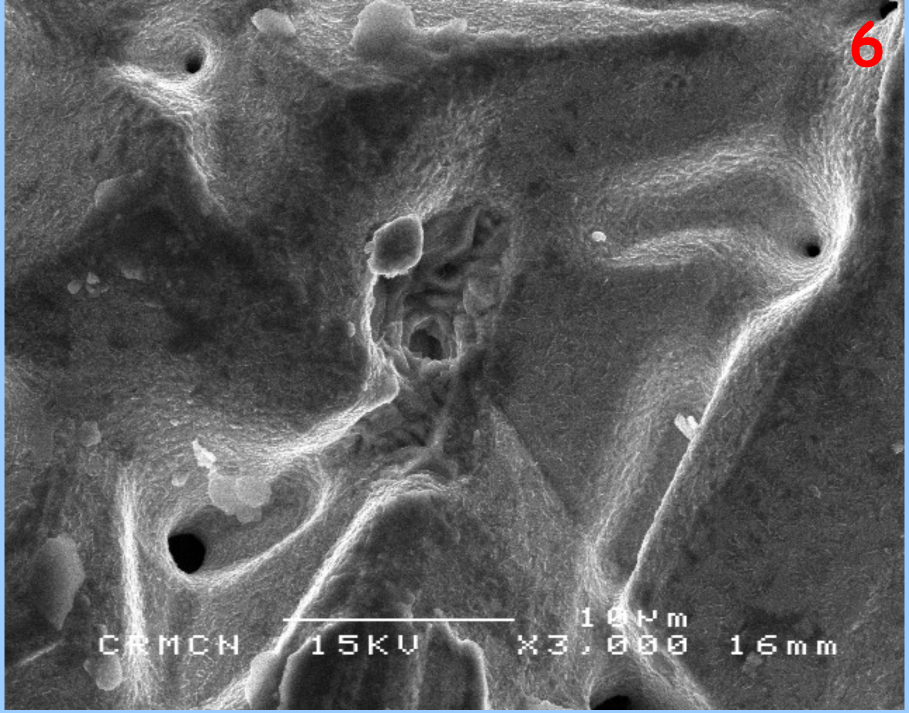


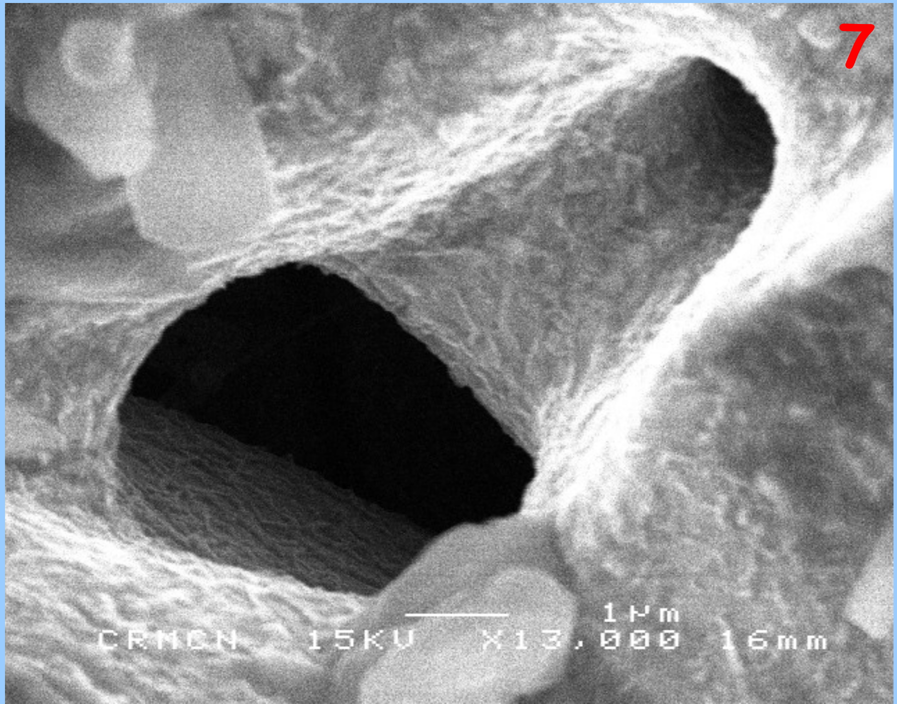







5
10µm
CRMCN 15KV X1,600 mm


6
10µm
CRMCN 15KV X3,000 16mm


7
1µm
CRMCN 15KV X13,000 16mm

Nano Pd powder manufacturing :

We have tried to produce nano particles of palladium by oxydizing a PdZr alloy. So far our attempts have failed.

We are currently investigating alternative ways of oxydizing the alloy at low temperature.

CONCLUSION

1- We have developed a reliable mass flow calorimeter

2- We have tried various solutions with a number of variables without success

3- We have observed a limited excess heat using a palladium tube having been subject to oxydation filled with palladium powder.

4- We are at present trying to manufacture the palladium nano powder : $Pd\text{-}ZrO_2$