

(57) **Abstract:** A method and apparatus for carrying out highly efficient exothermal reaction between nickel and hydrogen atoms in a tube, preferably, though not necessary, a metal tube filled by a nickel powder and heated to a high temperature, preferably, though not necessary, from 150 to 5000C are herein disclosed. In the inventive apparatus, hydrogen is injected into the metal tube containing a highly pressurized nickel powder having a pressure, preferably though not necessarily, from 2 to 20 bars.

David FOJT

ECAT 2011 NIH (no lithium)

31 03 2020

Beginning:

All started by Focardi/Piantelli works about NIH way.

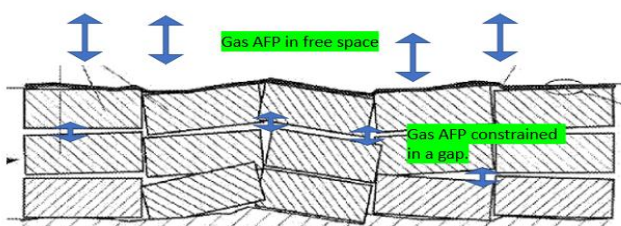
What are we talking about? Just Nickel bar heated to 200 °/300 ° under H₂.

How to understand these things? What does that mean: heating under H₂?

In fact, H₂ moves, vibrates in 3D following an average free path AFP depending on the T °.

By increasing T °, H₂ AFP also increases.

If AFP is constrained in a smaller gap, such as this picture from Piantelli's patent, what will happen?



The frequency so H₂ impact force (because H₂ inertia) onto Nickel will be greater. This is the "Venturi" effect.

However, pressure temporarily drops in this gap, then there will be pressure and T° bursts.

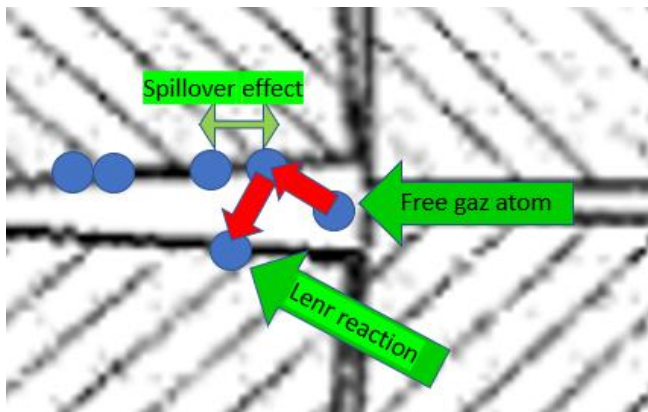
What is AR's technical contribution at this step? Increase reacting surface by micro/nanoparticles both with creation of a monoatomic H flow.

How are monoatomic H created in Piantelli/Focardi case? By a spillover effect, H₂ dissociates onto Nickel catalyst.

Personal thought at this stage:

I guess that monoatomic H cannot merge with surface that created them. (too long to explain).

If we see again Focardi/Piantelli picture, H₂ should be dissociated at Nickel one side then reacts only on other side by being projected there by shocks from other free gas molecules.



Rossi said:

In applicant exothermal reaction the hydrogen nuclei, due to a high absorbing capability of nickel, therefore, are compressed about the atom nuclei, while said high temperature generates inter-nuclear percussions which are made stronger by the catalytic action of optional elements».

Now, if we consider 100 years ago, the famous lithium transmutation experiment with hydrogen nuclei projected by a proton beam onto lithium layer. There were transmutations except that weak cross section. If Lenr needs to project a neutral atom, a proton beam would not be a good way.

How to do in this case?

By a venturi effect described above we can do that even if kinetic energy will remain very low, in regards of a conventional nuclear reaction.

However, higher will be number of H monoatomic knocks onto nickel higher will be probability that H electron's will be aligned between each nucleus, this is the main understanding of Rossi.

Now, how to create high level of monoatomic H with a relative kinetic energy?

From a theoretical point of view, conventional nuclear requires a minimum level of kinetic energy to run. Regarding Lenr, no need for pressure, temperature, mechanical actions, quickly, no need to add energy to reach Lenr. Lenr operates without energy added, it's just a story of keys to open. In most of Lenr experiments, there is no XH because these events are very rare however not because they do not exist. This is why we just need to increase the number of events!

Produce and maintain high level of H monoatomic is difficult because their very short life before very fast recombination. So, Rossi's main idea is to produce more H monoatomic than they recombine continuously.

Then carry them efficiently helped by ceramic carriers up to nickel particles bumping them.

Rossi main process:

In petrochemical field, it exists a reversible chemical catalyst reaction, the water gas shift reaction.

Rossi uses this one to massively and continuously make monoatomic H and OH which will bump nickel particles.

CO + H₂O = CO₂ + H₂ WGSR as well as reverse reaction RWGSR is CO₂ + H₂O = CO + H₂

Rossi uses these 2 reactions both to make a self-sustaining closed circuit.

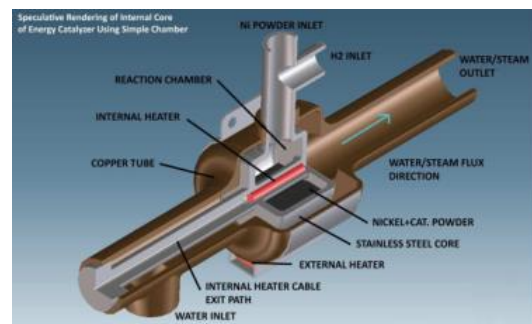
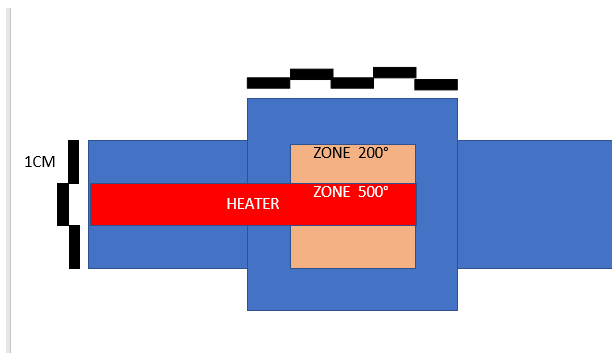
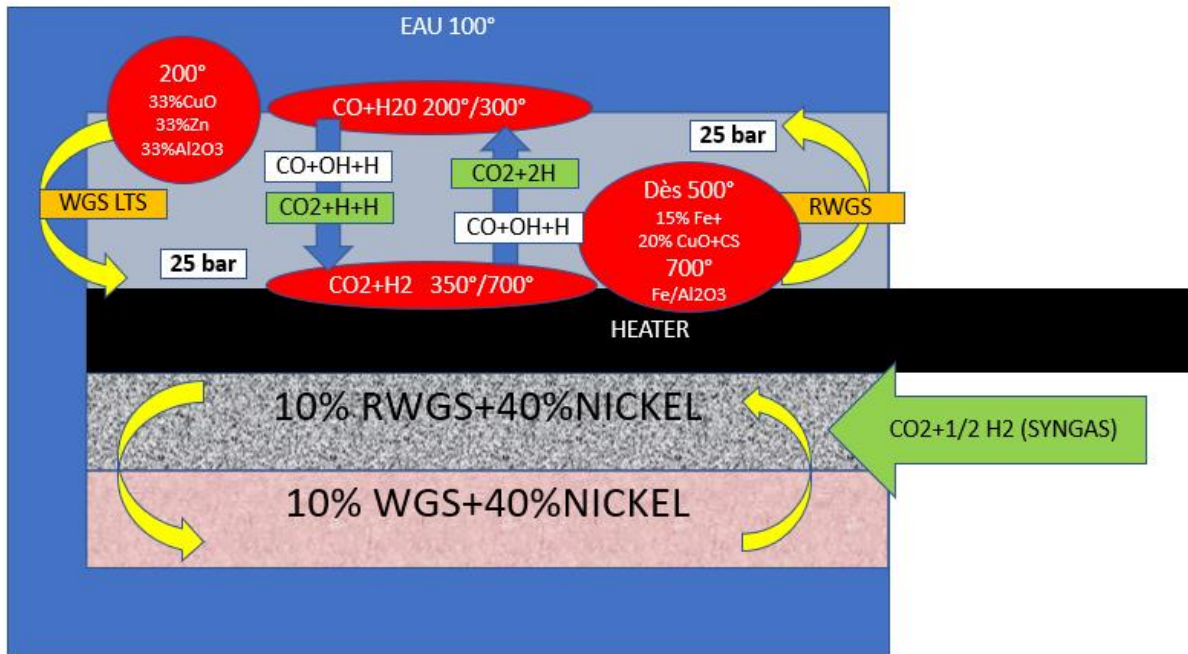
Here a picture from his first attempt:



Each reaction must have a specific catalyst, an optimal pressure to well run and above all a specific operating temperature.

Rossi runs both these 2 reactions in a closed circuit, gases circulating by convection helped by a T° difference (here around 250° up to more than 500°).

As you can see on picture it produces continuously H and OH.



the specific catalysts are mainly composed by copper for WGS (200 °) and iron for reverse reaction RWGS (500 °). No more than 20% of catalysts must be mixed with nickel.

What Rossi called "additives" are these 2 catalysts, what he called "secret catalyst" is the CO₂ necessary for these reactions (SYNGAS).

In accordance with various analyzes seen in literature, we find:

Copper and zinc for the low T ° catalyst and Iron for the HT catalyst.

Spacers/Carriers:

Rossi talks about 50 grs of nickel powder compressed in 50 cm³.

What does that mean?

50 grs of nickel powder compressed under 2 tons fill only 7 cm³.

So, Nickel powder fills only about 15% volume from reactor.

Considering a 3D matrix, with all particles at same average size, well separated from each other, we need to add ceramic spacers to fill the rest of volume, AL₂O₃, MgO₂, ZrO₂, for example. So, nickel powder comprising these 2 catalysts is embedded in 85% of these.

It's the same ratio used by Takahashi for Japanese powders.

As for Rossi, these spacers avoid sintering but are also great H monoatomic carriers, as Defkalion said in the past.

Theories side:

Rossi said:

he expressed appreciation for the recent article Generalized Theory of Bose-Einstein Condensation Nuclear Fusion for Hydrogen-Metal System by professor Yeong E. Kim (Purdue University, Indiana), «as it reflects an understanding of the basic principle behind the E-Cat better than the now prevalent WL theory.

From my side, I like too this French release from CEA's formers, about also bosons model according to Rossi's understanding.

**Note sur la possibilité de transmutations nucléaires à basse énergie
Michel Buxerolle et Jacques Kurdjian**

Now, the last relevant work, I found, is the Meulenberg's one, justifying Lenr reactions by an electronic spin/spin coupling.

Electron spin–spin coupling may be critical to some CF models:

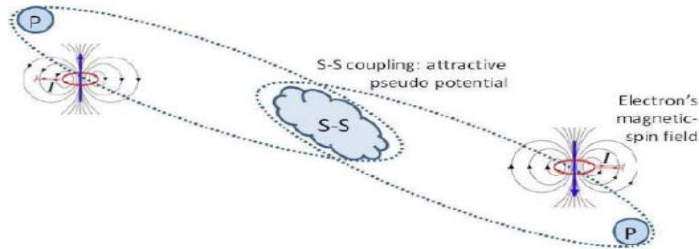


Figure 6. Magnetic field interactions producing a spin–spin attractive potential between electrons.

It should be understood that H monoatomic which knock on nickel has a sufficiently deformed orbit in transitory. However, H electron is not necessarily aligned between both nuclei. It's necessary to consider a statistic law, because there is only a fraction of H monoatomic which strikes nickel by a good alignment, shocks frequency remaining the most important parameter to align a maximum of electrons between 2 nuclei statically.

XH driving:

Rossi heats his Ecat with a 300W central heater.

If XH generated reaches the same value, Rossi would gradually decrease heater power.

Except that XH reach up to 15X maximum from heater power!

To control and stabilize the reaction, it's necessary both, to reduce heater power progressively when XH appears but it needs a very efficient cooling system too, justifying steam product rather than hot water. It's necessary to avoid reactor runaway at first, then avoid its shutdown because WGSR catalyst needs not too high temperature to run.

Electrolysis:

Rossi has also produced H monoatomic by electrolysis directly to switch WGSR then maintain RWGSR. As well as to stop the device, you just have to turn off electrolysis power supply, to easily control the process. However, despite having previously used electrolysis to produce hydrogen, then Rossi preferred to use pressurized hydrogen because probably more powerful even if electrolysis way seems to be more tunable.

Best Nickel isotope:

Rossi uses a regular nickel powder, whose isotopic composition is well known:

58 Ni (67,88%), 60 Ni (26,23%), 61 Ni (1,19%), 62 Ni (3,66%), 64 Ni (1,08%).

After that, he does a treatment to fit up to Ni62.

Does he use a neutron generator for that?