Introduction

This report refers to the experimental results of the two groups, Bologna (Focardi, Campari) and Siena (Piantelli, G, Montalbano, Veronesi) who have always worked at research into LENR.

All references cited in the course of this text are listed in chronological order, divided into four different blocks depending on whether they are articles published in refereed journals (R), of presentations made at national or international conferences, Academies (A), of the National Congress of the Italian physical society communications (S), master's thesis (T).

Research on nickel-hydrogen systems began from an experimental observation made by Francesco Piantelli towards the end of 1989 on a strange thermal effect, which occurred at low temperature in a sample of hydrogenated nickel. Piantelli talked with Focardi and Habel during the Conference of SIF held in Trento in October 1990 and they agreed to verify experimentally the phenomenon observed, taking into account the results obtained in electrolysis from Fleischmann, Hawkins and Pons (j. Electroanal. Chem, 261, 301 (1989)).
The experiments, which had been preceded by several experimental observations made in Siena from only Piantelli began to Bologna, Cagliari and Siena, of course conducted in the utmost secrecy, given the importance of the phenomenon that could have been used for energy transformations. Later, experiments were also performed in Colleferro and Pavia However the venue is the highest experimental activity occurred from the very beginning and also below has always been Siena.
The main difficulties encountered from the beginning have been the chronic lack of funding, limitation or always completely insufficient, having been able to rely only on 40% funds distributed locally in universities. It was possible that despite conducting a research activity by virtue of temporary loans, but in some cases become permanent from colleagues and friends, also to other universities, INFN and ENEA. Even today we borrowed two diffusion pumps, electronics from CISE, neutron monitor from a group of medical physics, a cloud Chamber of the city of Bologna. This is unfortunately of instruments that were built many years ago, much more accurate maintenance of their modern versions.
The first phase of the joint work was completed at the end of 1993 with the publication of the first results obtained (R1).
Proved on that occasion that nickel samples in hydrogen atmosphere, having absorbed a certain amount of gas at temperatures in the region 150-400 ^{0}C, heated with power between 40 and 120 W could, once the system had been disrupted with power or pressure variations, produce additional powers up to 50 w. In one case, the system, before stopping the process, was kept for 24 days in stationary conditions in which, with an output of 44 W, was produced a total energy of about 90 MJ. In this case, throughout the process was not observed any emission of penetrating radiation (neutrons and gamma rays) from the system. This first important result was preceded by numerous experimental observations (A1).

The first experimental observations (A1) made before 1994, numerous other systematic measures performed in Siena (6), in Bologna (2), in Colleferro (1), in Pavia (1) were added, bringing to 20 the complex of measures from which were deducted all observations of the phenomenon now in our possession.
Measures relating to the power produced by the system, described in detail in (R2), were carried out, starting from 1994, using Newton's law of the Convention that allows, through measures of temperature at a particular location of experimental cell surface temperature in a laboratory, to determine the heat output that can be compared (thanks to an initial calibration performed before the system produces energy) with than electricity supplied to the system.

Hydrogen absorption in nickel

The observed phenomena, thermal power generation by the Ni-H, occur only after a certain amount of hydrogen was absorbed by the nickel. The amount of hydrogen absorbed is not constant and depends most likely from the treatment suffered by the sample. In some situations there are no phenomena of absorption, in other the amount of hydrogen absorbed were particularly low, while others were very high and carried out quickly (A2, A6). To ensure that the reduction of hydrogen pressure inside the experimental cell was not due to sealing problems has always worked with hydrogen pressures less than bar (R1), reconstituting the initial value as the pressure was reduced following removals. The whole loading process lasted only 80 hours if faster place (A3, T4); in General took several days before it is completed. Also, never mentioned in the previous literature phenomenon, has observed the existence of some temperatures at which the amount of absorbed (by the nickel) per unit of time particularly high values (A3). The variability of such loading concluded that this first trial is essential if you experience any of the following phenomena observed. In other words, if the metal doesn't absorb hydrogen there is no effect. The presence of gas absorption was highlighted, as well as by the decrease of pressure, even by the fact that, in these cases, the experimental diagram pressure-power is in total disagreement in some places with Gay-Lussac's law between pressure and temperature, showing also clear indications of a phenomenon of hysteresis (A3).

Energy production by the Ni-H

The first observations of the system energy output were based on variations in temperature Platinum heater located inside the experimental cells, contained in a simple experimental apparatus, whose description can be found in (R1). Later, stimulated by some criticism that they advanced the hypothesis that the observed effect depended on changes in the electrical resistance of the Platinum produced by absorption of hydrogen by the Platinum itself, we decided to measure the effects observed from the outside of the cells (R2). In summary the method uses Newton's law of convection: is to measure the temperature on a thermometer, distant place in the same laboratory, a cell wall point by varying the electrical power input (experimental calibration curve) and when comparing similar curves obtained when the system produces energy with that of calibration. The best results were obtained with two cells that produced about 900 MJ and MJ 600 working before being arrested, respectively for 278 days and 319 days.

Observation of nuclear events

In the course of the trials lasted for over fifteen years were observed several phenomena that bear witness to the aftermath of nuclear reactions within the samples of Ni to H. One of the experimental cells, one that produced about 900 MJ, while producing energy, uttered a few days neutrons that were observed with two different techniques, using neutron counters to He^3 and gold activation technique. The latter (R3) allowed him to assess the flow of neutrons emitted from experimental cell 10 neutrons/cm^2s equal to 1000 times the estimated flow of neutrons contained in cosmic radiation.
On more than one occasion was observed by different experimental cells, emitting gamma radiation, highlighted by comparing the spectrum of gamma rays detected by NaI and counters with germanium counters, which are located in the immediate vicinity of the cells, with that of normal background radiation environment (A3).
The champion of Ni retrieved at the end of the experiment, from the cell that produced about 900 MJ left several hours in contact with a photographic emulsion left a radiographic footprint (T4). The same sample, then placed inside a cloud Chamber, allowed to photograph evidence of heavy particles (A4).
Other events, which may have been caused only by nuclear reactions, were observed at the end of the experiments using the technique SEM EDX for surface analysis of samples used. Having in mind the fact that the system we use is initially the couple gas-metal consists of hydrogen and nickel, the presence on the surfaces of other items, in addition to the Ni, cannot have been produced by nuclear reactions. As featured in (A4), overall were observed in addition to Cu and Zn, Ni, even heavier than F, Na, Mg, Al, Si, P, S, Cl, K, Ca, Mn, Cl and F.

(R1) **S. Focardi, r. Habel and f. Piantelli**,- *Anomalous Heat Production in Ni-H Systems*. The new Cimento1994, Vol 163-167, pp 107A

(R2) **S. Focardi, v. G, v. Montalbano, f. Piantelli and s. Veronesi** - *Large excess heat production in Ni-H Systems*. Il Nuovo Cimento 1998, Vol 111A, pp 1233-1242.

(R3) **Battaglia, l. Daddi, s. Focardi, v. G, v. Montalbano, f. Piantelli, P.G. Sona and s. Veronesi** - *Neutron emission in Ni-H Systems*. Il Nuovo Cimento 1999, pp 921-931 112A, Vol.

(A1) F. Piantelli, Atti Accad. Fisiocritici, series XV, Tome XXII, p 89 (1993).

(A2) **S. Focardi, v. G, v. Montalbano, f. Piantelli and s. Veronesi**, Atti Accad. Fisiocritici, series XV, Tomo XV, (1996), pages 109-115.

(A3) **s. Focardi, v. G, v. Montalbano, f. Piantelli and s. Veronesi** - *On the Ni-H System*. Conference Proceeding vol 64, "Asti Workshop on Anomalies in Hydrogen/Deuterium loaded metals, W.J.M.F. Collis (Ed.), SIF Bologna 1999 pp 35-47.

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(A4) **e. g. Campari, s. Focardi, v. G, v. Montalbano, f. Piantelli, e. Porcu, e. Tosti and s. Veronesi –** *Ni-H Systems.* Proceedings of the 8th International Conference on Cold Fusion, Lerici (La Spezia), Italy 21-26 May 2000, pp 69-74.

(A5) **E. G. Campari, S. Focardi, V. G, V. Montalbano, F. Piantelli, S. Veronesi-??** Proceedings Workshop TESMI, a. Larson and v. N eds, Lecce, 2002 35 (2002).

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(A8) **E. g. Campari, s. Focardi, v. G, v. Montalbano, f. Piantelli, s. Veronesi** -Surface Analysis of hydrogen loaded nickel alloys, The 11th International Conference on Condensed Matter Nuclear Science, 31 October-5 November 2004 in Marseille.

(A9) **E. g. Campari, g. Fasano, s. Focardi, g. Larson, v. G, v. Montalbano, f. Piantelli, c. Salmon, s. Veronesi** - Photon and particle emission, heat production and surface transformation in Ni-H system, The 11th International Conference on Condensed Matter Nuclear Science, Marseille 31 October-5 November 2004

The 6 International Workshop on Anomalies in Hydrogen/Deuterium loaded Metals May 2005 13-16, Siena

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(T2) **Lara Sam** - *measures of neutrons emitted in cold fusion processes*, University of Bologna, academic year 1994-1995, autumn session.

(T3) **Raffaele Many** - *environmental radioactivity measurements*, University of Bologna, academic year 1994-1995, third session.

(T4) **Alessandro Ventura** - *An experimental apparatus for the study of Ni-H systems*. University of Bologna, academic year 1995-1996, summer session.

(T5) **Anna Elizabeth Zajc** - *gamma radiation spectrum with germanium detectors and sodium iodide*, Bologna University, academic year 1995-1996, autumn session.

(T6) **Barbara Mirri** - *nickel-hydrogen systems*, University of Bologna, academic year 1995-1996, winter session.

(T7) **Helen Faulkner** - *characteristics of Ni-H in the region 300-500* ^{0}C, Bologna University, academic year 1995-1996, winter session.

(T8) **Joseph Combed** - *detection of neutrons (and < 10 MeV) with a scintillation counter NaI (Tl)*, University of Bologna, academic year 1995-1996, winter session.

(T9) **Annalisa Bernardini** - *study of nuclear processes in Ni-H*, Bologna University, academic year 1996-1997, the second session.

(T10) **Boris Neighbors** - *Ni-H systems phenomena*, University of Bologna, academic year 1996-1997, third session.

(T11) **Paola Zucchetti** - *evidence of nuclear reactions in nickel-hydrogen systems*, advanced course in physics, University of Bologna, academic year 1996-1997.

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