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The abundant Excess Heat Production during Low Energy Nuclear Reaction in the Nano Scale Solid State – The Cold Fusion, 14 years' Legacy

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Abstract

The quite abundant excess heat and radioactive materials are found during the solid state reaction. This phenomenon has done during the Low Energy Nuclear Reaction (LENR) in the nano scale molecular structure electrodes and Hydrogen compound electrolytes. The Palladium (or Nickel) and Platinum are incorporated as the electrode and the Light Water (H_2O) as the electrolyte. The excess heat was produced up to 40% in year 2001. The Alpha particles are also detected. The computer code, Coherent Lattice Accelerator Inter-Ionic Reaction Enhancer (CLAIRE) Code System, is constructed for the simulation. The 0.1 Å of the distance between two the Hydrogen ion (proton) and Palladium nucleus is the critical point for the nuclear fusion reaction.

1. Introduction

During a number of low energy nuclear reactions using some electrodes, mysterious results were observed [1], such as the paradox of low neutron emission compared to the number of fusion needed to generate the release energy, together with the unexpectedly high fusion reaction rates rising with the temperature decrease [2].

The LENR group has produced several research outputs about the evidences of the nuclear fusion reaction in the low temperature or in the room temperature [3]-[7]. The molecular structures are well described in Fig. 1 and 2 [8], [9]. Although, there is a controversial debating of the real existence of the Cold Fusion, the excess heat production rate is increasing following the refined skill improvements.

2. The Methodological Skills

The skills are classified as the electrode manufacturing, the electrolyte selection, and the running method. The electrodes are used as the thin film type for the possible mass production in the commercialization [10]. The electrodes (Palladium, Platinum) are very expensive. So, the Palladium is tried to exchange with the Nickel or some other combinations of the materials as a cathode. The semi-conductor process is hired for the experiment. The Light Water (H_2O) is used for the electrolyte. The Heavy Water (D_2O) is used for the electromagnetic nuclear fusion and the Pons-Fleishmann type Cold Fusion. But, Heavy Water is also very expensive and there was a good result, although the Light Water was used. The calorimeter running is important, too. Sometimes the thin film on the substrate is broken and this results the experiment to be failed. The excess heat result is shown in Fig. 3 [11]. This was done using calorimeter calculation. The Table 1 and 2 [11] show the excess heat result where the maximum 40% electrical power excess heat produced by LENR experiment.

3. Computer Simulation

CLAIRE Code System is used for the simulation of LENR like the Cold Fusion. It is easy to simulate the dynamics of charged particles embedded within a metal lattice in the cases of Palladium or Nickel. The code can show the dynamics of two particles [8], [9], [12], [15]. The one is the 'shot' particle which is entering the trap by diffusion with a random energy, and the other one is 'target', which is initially at rest within a lattice site and in motion after interaction with 'shot' particle. The graphical simulation shows the evolution of the distance between particles and the coordinates of the shot, and the energy of shot. The three different projections of the particle animation are given in the left side of the screen [13].

Fig. 4 represents the result of a classical study of a "collision" between two deuterons. It is assumed that particle 2 is at rest within a tetrahedral site [r'_2 (t=1) = 0.5, z'_2 (t=0) = 0], which particle 1 is entering the trap with initial position, direction, and energy evaluated randomly, but effective to have a collision. The initial position of such a particle is r'_1 (t = 0) = 0.5, z'_1 (t = 0) = 1. The identical conditions of the velocity components, chosen randomly, do not modify the dynamics of the particle, because if the particle is supposed to be initially at thermal energy, the effect of the trap force dominates [14].

The nuclear fusion can be done when the distance between 'shot' and 'target' particles is below 0.1 Å. Fig. 5 shows the series of simulation in two cases of distances between 'shot' and 'target' particles [15]. The first figure is the distance between proton and Palladium particle changing the frequency where the screen factor is 4. The distance is increasing as the frequency decreases. The second one is the distance changing the screen factor. In this case, the distance decreases as the screen factor increases.

4. Result

The experimental running and computer simulation for the LENR in the nano scale solid state have been done. The Cold Fusion event was investigated by the improved methodology. The semi-conductor based thin film electrodes make several kinds of electrodes on the substrates. This material property is studied furthermore following the output. The excess heat produced up to 40% in the room temperature condition.

5. Conclusion

The Cold Fusion research has been done during last 14 years. New theory and experiment have come out. The LENR group's result is one of best results in the peer research groups. The recent Sonoluminescence incorporated Bubble Fusion [16], [17] is another kind of low temperature Fusion, if it is well proved as a Nuclear Fusion Reaction. However, just the solid state Fusion has been very much performed among the Cold Fusion research groups until now. Although, it is in a 'baby-walking state', the variety of research trials have been done. The Bubble Fusion is a good competitive partner for the solid state Cold Fusion such as the relationship between the Tokamak Fusion and Inertial Confinement Fusion (ICF). The increasing excess heat is the main object for the commercialization. Therefore, although the evidence of Fusion reaction is unstable, it is encouraged to continue the Cold Fusion research.

6. Acknowledgements

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7. References

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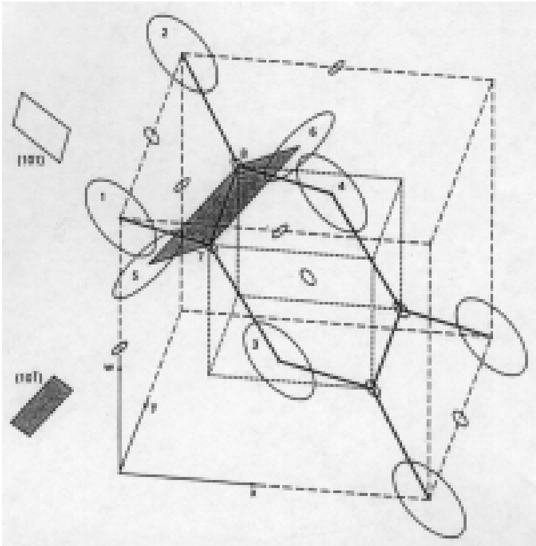

Fig. 1 The 1 0 1 plane and its orthogonal plane 1 0 $\overline{1}$ (dashed area); two tetrahedral sites belong to the intersection between the planes. The large ellipse denotes the Palladium ions, and small ellipse denote the D+ ions. A similarity can envisage between the quadruple ion trap and the system shown in the figure.

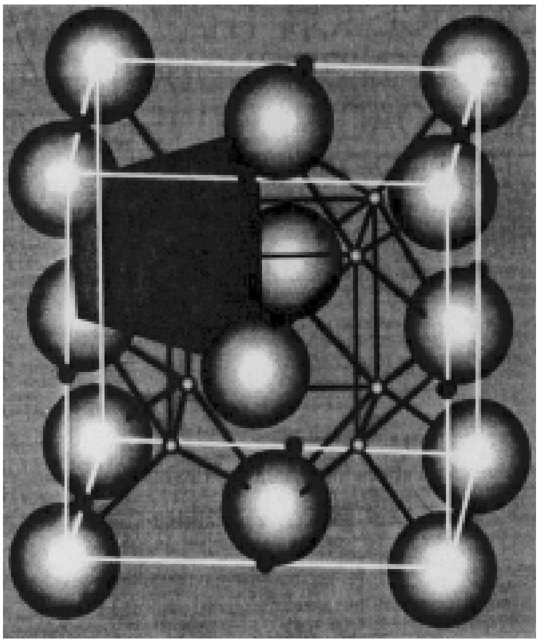

Fig. 2 Palladium-Deuterium Lattice Cell

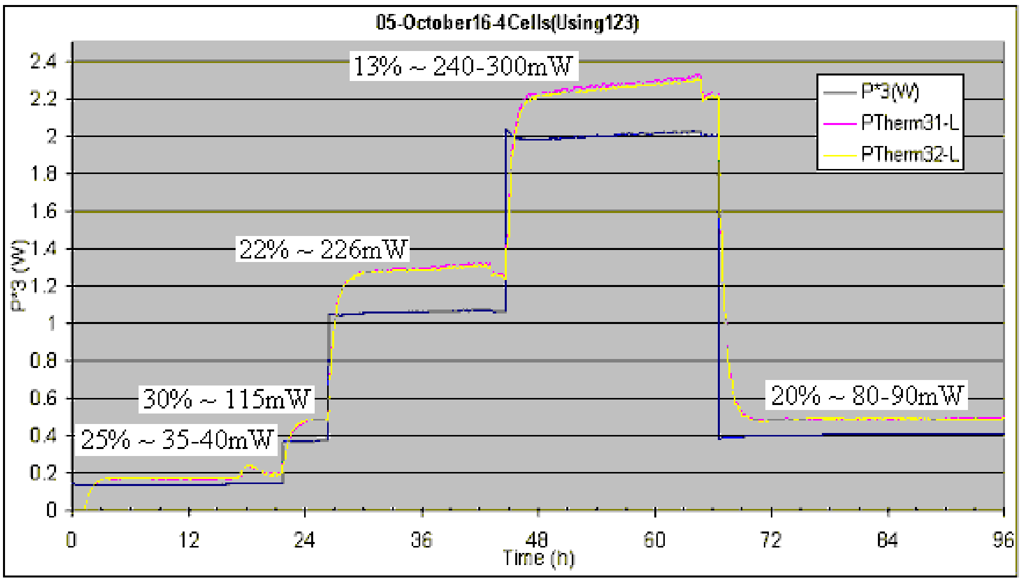

Fig. 3 The Calorimeter result of two layers Electrode. 8000Å Pd and 1000Å Ni on Alumina.

ID-Date	Amount	Commentaries
Aug-23-01	No Excess	Sample Destroyed
Aug-23-01	No Excess	Sample Destroyed
Aug-23-01	No Excess	Al_2O_3-Pd
Oct-16-01	15%-30%	Al_2O_3-Pd-Ni
Oct-19-01	5%-40%	Pt-Pt_B-Pd_B-Pt_B-Pd_B
Oct-19-01	3%-12%	Cu-Pd
Oct-26-01	4%-15%	Pt-Pt_B-Pd_B-Pt_B-Pd_B
Oct-26-01	5%-20%	Cu-Pd

Table 1 Excess Heat (1/2)

ID-Date	Amount	Commentaries
Nov-5-01	6%-21%	Macor-Pd-Ni
Jan-12-02	No	Cu-Pd
Jan-12-02	Negative	Electrolysis of Ag (error)
Jan-12-02	5%-10%	Pt-Pt_B-Pd_B-Pt_B-Pd_B
Jan-20-02	18%-27%	Al_2O_3-Pd
Jan-20-02	No	Sample Destroyed
Jan-20-02	No	Sample Destroyed

Table 2 Excess Heat (2/2)

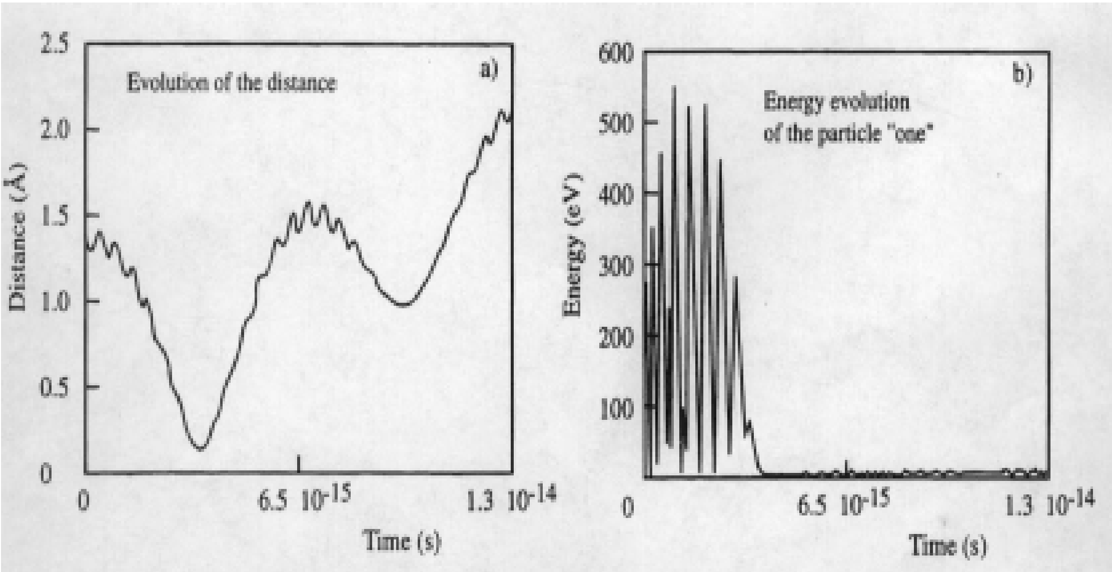

Fig. 4 Distance and Energy

Fig. 5 Two simulations cases for the distance