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Cold Fusion Reactor with Nanoporous Metal Papers for simultaneous D Loading and Cold Fusion

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Abstract:- The excess heat generation of Cold Fusion is determined by the total fusion reaction site on the metal surface and the supply speed of D to the reaction site. In order to increase the reaction site, generally nano-roughness or nano-structure is used on the metal surface, and it is believed that conceptually D supply through the very thin metal film is the best option in the cold fusion community, however, the mechanism is unclear and no available reactor at the engineering stage is not available due to the difficulty to fabricate such thin film structure with sufficient strength and thinness.

Thus, I proposed the conceptualized Reactor with the recently developed nano porous metal papers, which has the larger number of the reaction site on the fiber surface, and it is considered to be thin enough and strong enough for Cold fusion metal.

The D can be supplied from the back surface and cold fusion is on the front-surface with the proper voltage applied to each counter-electrodes; for D loading counter-electrode is with positive and metal surface potential is negative, and for Cold fusion counter-electrode is with negative for positive metal surface potential. Because this configuration enables the ^{4}He-ash ejection from at the surface T site, and it will improve the performance of cold fusion.

Because the nano-porous paper is made of the fiber of nickel, it is semi-transparent, and do not have the capability to block the D2O and H2O. Thus, the nickel metal deposition the backside surface of this nano-porous nickel paper can block the D2O/H2O mixing in the reactor; where H2O is in the Cold Fusion side and D2O is in the D loading side.

Keywords:- *LENR, Cold Fusion, Nano Porous Metal Papers, FPE, Fleishmann And Pons Effect, FPE, Nano-Metal Particle.*

I. INTRODUCTION

In 1989, Martin Fleischmann and Stanley Pons were catapulted into the limelight with their claim to have achieved fusion in a simple tabletop apparatus working at room temperature [1]. Their report described an experiment involving electrolysis using D_2O in which the cathode fused (melting point 1544 ºC) and partially vaporized, and the fume cupboard housing the experimental cell was partially destroyed.

1.1 Cold Fusion Mechanism Overview

I summarized Fleishmann, S. Pons experimental tool and mechanism of cold fusion in ref [2],[3],[4].

1.1.3 Cold Fusion mechanism

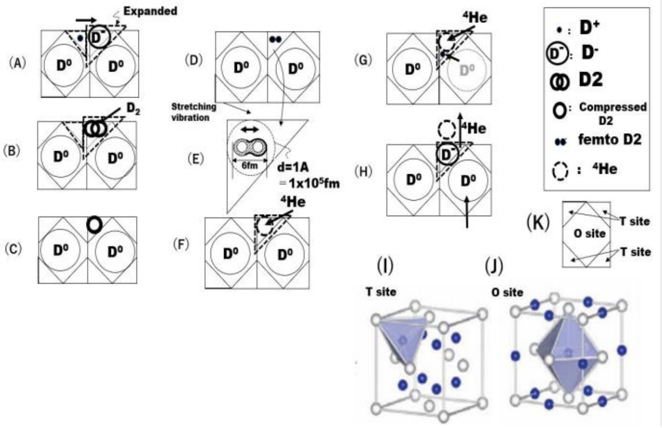


Fig.1. Cold Fusion Mechanism.

I summarize the mechanism of cold fusion briefly and so please read the ref [2],[3],[4].

(A) Cold Fusion starts after D loading inside metal.

D^- at the expanded surface metal due to the electronegativity of the surrounding lattice atoms, which transfer electron to D, which changes D to D- at surface T site and T site is expanded.

(B) D^+ join to D^- to be D_2 at the surface T site, with coulomb attractive force between D^+ and D^- and by the hopping of D^+ to D^-.

(C) D_2 is compressed by the surrounding expanded lattice T site atoms.

(D) Small D_2 is created based on electron deep orbit, explained in ref [2]; small D_2 is the tightly bound d and electron pair, in case of small H is the neutron (tightly bound proton-electron pair in ref [3].

(E) Small D_2

(F) d+d=^{4}He

(G) D^+ move to Surface T site with ^{4}He

(H) D^+ turn to D^- and expansion to D^- can eject ^{4}He at the surface T site.

II. OVERVIEW OF THE REQUIREMENT ON COLD FUSION BASED ON THE COLD FUSION MECHANISM

2.1 Requirement of Cold Fusion Reactor

Nano structure on the cold fusion surface with larger total surface area

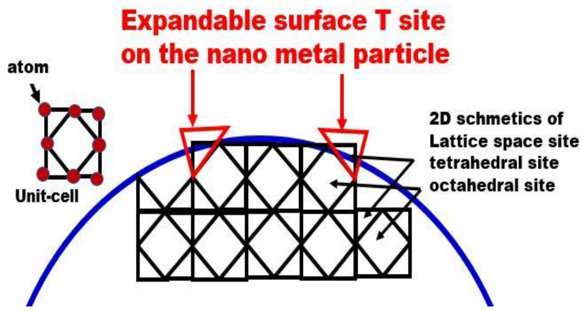


Fig.2. Mechanism of nano roughness to cause Cold Fusion

Nano-particle is used to improve the heat generation as is explained in ref [4], which has the nano-roughness, with curvature shown in Fig.2. The metal with nano roughness has large total surface area with expandable surface T site, as is shown in Fig.1 (A) because surface unit cell on the nano-roughness is expandable due to the lack of the surrounding lattice atoms, and Cold Fusion can be caused by the compression of D-D bonding [2],[4].

2.2 Metal surface Potential control

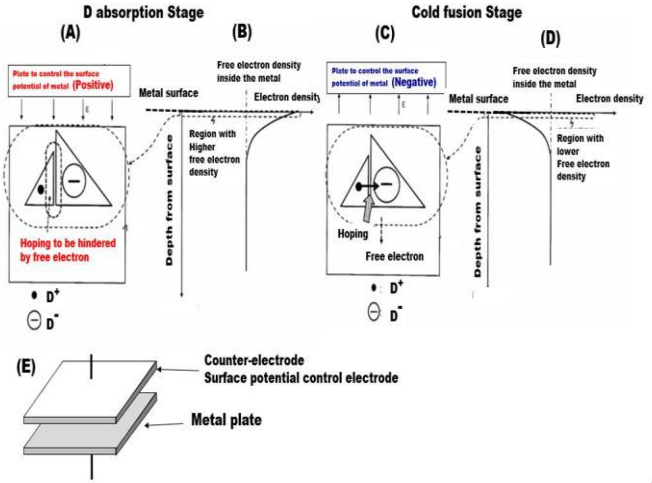


Fig.3.Mechanism to enhance cold fusion under positive surface potential of the metal.

In Fig.3 explains the cause of positive surface potential can enhance the cold fusion because in Fig.1. (A)-(B), D+ join to D- at the surface T site, by the hopping of D^+ assisted by coulomb attractive force, so free electron can hinder D^+ hopping.

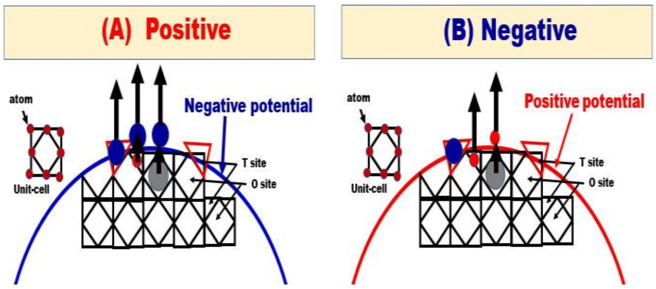


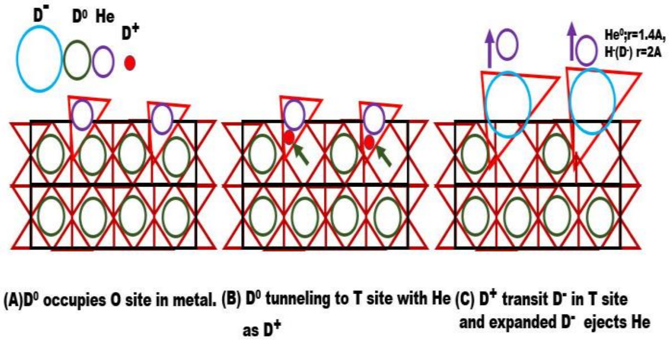
Fig.4. Ion current and applied voltage of electrode in LEC [4][5]

Another interpretation is explained in ref [4] with the data on cold fusion experiment [5]. Important feature of hydrogen is that hydrogen can be positive and negative depending on the electronic state around hydrogen. In case that free electron exists around D, it can be D^- but less free electron D can be D^+.

This has been studied by the researchers on hydrogen storage metal and has been proved by theoretical study.

Necessity of the metal surface potential control is the most important understanding because original experiment of FP Experiment [1] used the electrolysis condition with anode of the counter electrode, which means that the metal surface potential is negative, which is opposite polarity to cold fusion condition; surface potential must be positive for Cold Fusion.

2.3 D supply from the backside to eject ^{4}He ash at surface T site

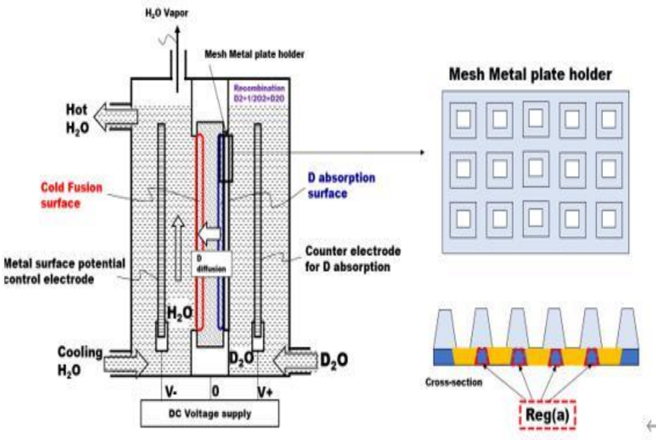


(A)D^0 occupies O site in metal. (B) D^0 tunneling to T site with He as D^+ (C) D^+ transit D^- in T site and expanded D^- ejects He

Fig.4. Mechanism of better efficiency of D supply from the backside.[3]

The surface T site has the 4He ash after the fusion of d+d and they are confined at surface T site, and it is believed that through very thin metal film and diffusion from the backside is important for cold fusion. I presume that the cause is the 4He ejection from D+ supply from the backside to the surface T site with ^{4}He ash, as is shown in Fig.4.

2.4 D supply from the backside and Cold Fusion on Front side [2]



The total excess heat generation is determined by the D supply to the Cold Fusion site on the metal surface, so it is best to load D from the backside and Cold Fusion on the front side, which can eject ^{4}He ash at the surface T site. The metal film needs to be very thin and thus has the risk of cracking by high temperature of cold fusion, so some compromise is needed, and so I searched for available technique and found the nano-porous nickel paper as is in Fig.6.

III. CONCEPTUALIZED COLD FUSION REACTOR

3.1 Reactor with Nano-porous Nickel Papers

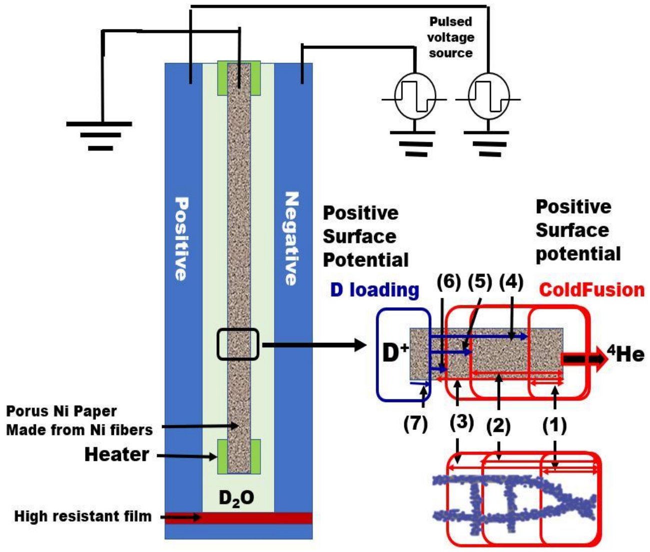


Fig. 5. Conceptualized Cold Fusion Reactor with nano-paper for simultaneous cold fusion and D loading

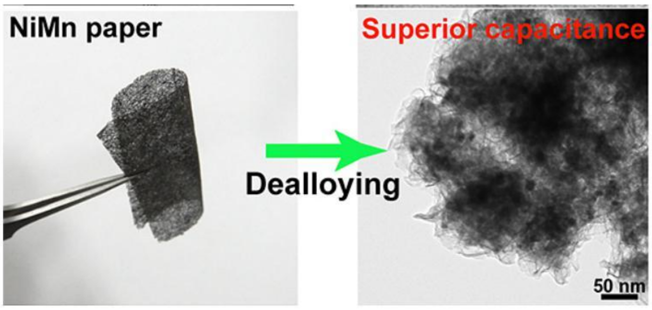


Fig.6. Bendable thin Ni 30 Mn 70 alloy sheet.[6]

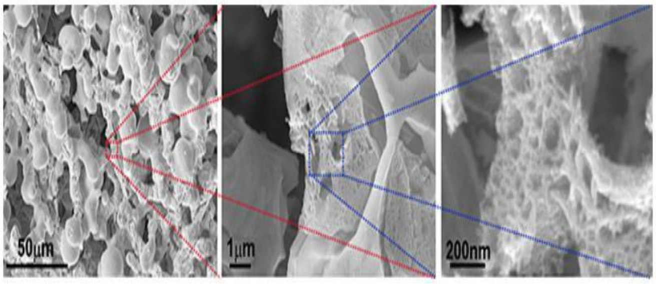


Fig. 7 SEM image of the porous nickel [6]

In ref[6] Nano porous Metal Papers of Advanced nanostructured electrodes were reported for such as supercapacitors, batteries, and electrochemical catalyst/conversion technologies. The feature of nano-porous paper is high total surface area for superior areal capacitance with high mechanical ductility.

This can be used in Cold Fusion Reactor to enhance the performance. Although the development of Reactor with nano-metal is in progress, it is very difficult to control the surface potential due to the isolated particles.

Thus, I propose the conceptualized Cold Fusion Reactor with the latest technology of nano-porous nickel paper. With this paper, D supply from the backside to eject 4He ash it is feasible.

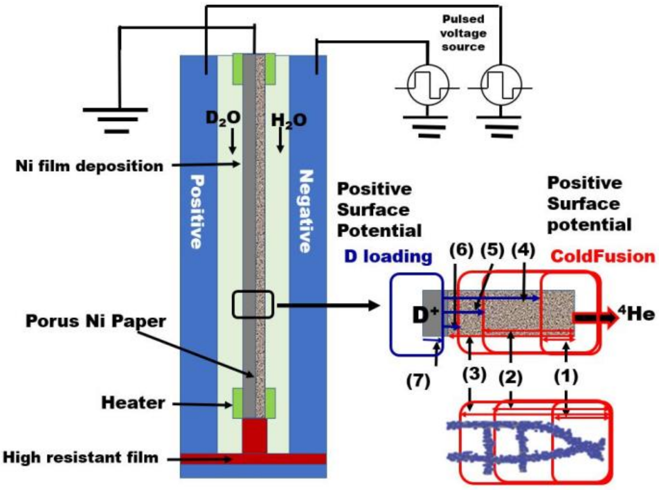


Fig. 6. Conceptualized Cold Fusion Reactor with nano-paper with Ni film on the backside for simultaneous cold fusion and D loading

Because as is shown in Fig.5, this metal electrode is a paper made from nickel fiber, electric filed can be deeper and the total surface area of the nickel fiber with positive surface potential for cold fusion can be increased drastically compared with the bulk metal. In Fig.5(7), for D loading, high electric filed grows the insulator which cut the current path, so electric filed need to be weak enough. For Cold Fusion case, the increase of electric filed can widen the depth of cold fusion region shown in Fig5(1), (2), (3), thus the total reaction surface area can be larger with increasing the voltage of the counter-electrode, and distance from front of D supply to the backside of Cold fusion region can be shorter by deeper cold fusion depth shown in Fig.5, (4)-(5)-(6). Thus, the voltage of counter-electrode on the front side can control the cold fusion heat generation.

As is shown in Fig.5, this sheet is a paper made from nickel fiber, so it has transparent as is shown in Fig.6. Thus, this sheet cannot block the H2O/D2O flow through the paper.

In order to block the flow, the nickel thin layer is deposited on the backside of the paper as is shown in Fig.6 for the easy control of the quality of D_2O, not used as coolant of Cold Fusion. Due to the insulating film growth, the electric filed need to be low enough for D Loading, so the backside metal deposition is OK because backside electric filed cannot control the cold fusion due to the low electric filed.

IV. SUMMARY

I proposed the conceptualized Reactor for simultaneous D loading and Cold Fusion because it can have the higher excess heat than conventional reactor due to the faster and larger amount of D supply to Cold Fusion region if D can supply from the backside of thin metal films.

Lately the new Nano porous Metal Papers metal papers have been developed with very large surface area for the capacitor electrode, with high mechanical ductility. This paper has the porous surface which can have the larger surface T site with D- and the total surface are for the cold fusion on the front surface of papers can be wider with higher electric filed, and this can have the shorter distance between D supply location and Cold Fusion location both of which can contribute the excess heat generation.

ACKNOWLEDGMENT

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