

Full atomic theory of cold fusion

Qing-Quan Gou*

Institute of Atomic and Molecular Physics, Sichuan University, Chengdu 610065, China

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Abstract. A primary theory for the cold fusion mechanism is proposed early in 1989 by us based on atomic, molecular, nuclear and crystal physics. According to this theory, the cold fusion of deuterons may be raised in crystal with produce of excess heat and fusion products ^4He . After this theory, the remarkable effects of excess heat and fusion products ^4He were observed during the electrolysis of heavy water with Pd or Ti electrodes in our experimental researches. These results indicate that the prediction in our theory is valid. In order to get more clear understanding for the cold fusion, further theoretical and experimental studies had been carried out extensively by us in the past twenty years. Through a deep analysis, we find that the cold fusion is arised from the interaction of two adjacent full atoms (contain nucleus and valence electrons) of heavy hydrogen in the interstitial position of crystal. This full atomic theory will be discussed in detail in this paper. According to this theory, we find out that ^3He may be made from the cold fusion of heavy hydrogen and hydrogen atoms.

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Key words: cold fusion, full atomic theory

1 Introduction

Two decades ago, Fleischmann and Pons [1] reported excess heat generation during electrolysis of D_2O on Pd electrodes. In particular, they reported that during electrolysis, the excess heat is generated in the amounts that could not be accounted for by any known physical or chemical process. Hence, it must be of a nuclear origin. In the months and years that followed, the tritium and helium production were discovered in Pd/D electrode [2–5]. The nuclear production would be formed from the nuclear fusion of D in the Pd crystal. This nuclear fusion is raised in the crystal at ordinary temperature and is called cold fusion. This is a very important result. But to search out the cold fusion mechanism is a more important basic research work.

*Corresponding author. *Email address:* jams@scu.edu.cn (Q. Q. Gou)

A primary theory for the cold fusion mechanism is proposed early in 1989 by us based on atomic, molecular, nuclear and crystal physics [2]. We think that when a deuterium atom is absorbed by a palladium crystal and penetrate into the interstitial position, its electronic cloud sphere will be expanded into a large one due to the attraction of the surrounding six palladium atomic cores, as show in Fig.1. Therefore the binding energy between the deuteron and its valence electron is greatly decreased and the deuteron is highly mobile in the large cloud sphere. The repulsive force between two neighboring deuterons immersed in the electronic cloud is greatly decreased due to the screen effect. Therefore the close collision between the deuterons and nuclear fusion will be raised easily and do not need very high temperature. The fusion products are ^4He and its fusion energy is used to rise the temperature of the crystal and give out excess heat. After this theory, the remarkable effects of excess heat and fusion products ^4He were observed during the electrolysis of heavy water with Pd or Ti electrodes in our experimental researchers [2]. These results indicate that the prediction in our theory is valid. We know, however, that there are many scientists still can not understood clearly for the cold fusion mechanism. In order to get more clear understanding for the cold fusion, the further theoretical and experimental research has been studied repeatedly by us in the past twenty years. Through a deep analysis, we find that the cold fusion is raised from the interaction of two adjacent full atoms (contain nucleus and valence electrons) of heavy hydrogen in the interstitial position of the crystal. We shall proceed now to discuss this full atomic theory in detail in the following paragraphs.

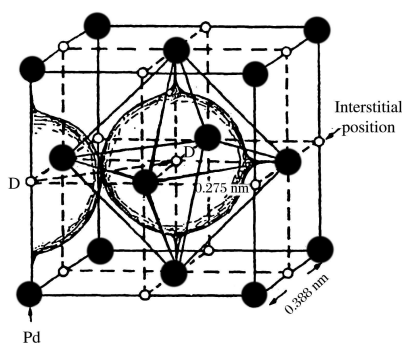


Figure 1: Sketch of the state of two adjacent deuterium atoms in palladium crystal

2 Full atomic state of the interstitial atom in crystal

For simplicity, we can see from Fig. 1 that the state form of the interstitial atom is a sphere with radius 0.137 nm as shown in Fig. 2 [3]. Its valence electronic cloud is distributed entirely in the inner side of the sphere and its deuteron is highly mobile in the sphere. This state denotes a full atom enclosed in a sphere with radius 0.137 nm. The quantity of

the negative charge of valence electron and the positive charge of deuteron are equal. The total charge is zero in the sphere. There are no electric force at outside of the sphere due to the repulsive force of the deuteron is screened by the valence electron in the sphere. The repulsive force between two deuterons moving in the two contact spheres as shown in Fig. 1 is very small due to the screen effect of their valence electrons. Therefore the close collision between the two deuterons and nuclear fusion will be raised easily and do not need very high temperature.

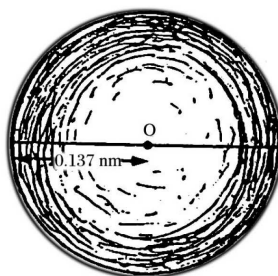
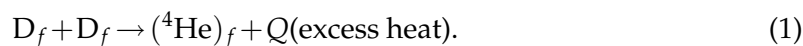


Figure 2: Three-dimensionally simplified distribution of electronic cloud of heavy hydrogen atom in Pd crystal

3 The full atomic fusion of two deuterium atoms in palladium crystal

The full atomic states of two deuterium atoms in the two neighboring interstitial positions of the palladium crystal may be represented by two contact spherical full atoms as shown in Fig. 3. The repulsive force between the deuteron in the left sphere and the deuteron in the right sphere is greatly decreased due to the screen effect of their valence electrons. They may meet at the contact point of the two spheres easily at ordinary temperature and fuse into ^4He . In the same time, their valence electrons are fused to be the two valence electrons of ^4He . Therefore the cold fusion between two neighboring full atomic deuterium D_f will be raised. The fusion produce full atom $(^4\text{He})_f$ and excess heat Q . The heat energy Q is the increase of excitation energy of the crystal gained from the high excited energy of ^4He . Therefore, the full atomic fusion may be written



4 ^3He may be formed from the full atomic fusion between deuterium atom and hydrogen atom

We may see from Fig. 3 that ^3He atom may be formed if the right sphere D_f is replaced by hydrogen sphere H_f as shown in Fig. 4. Eq. (1) becomes

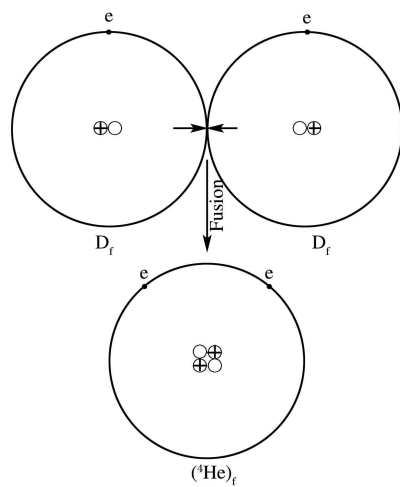


Figure 3: Full atomic Fusion of two deuterium atoms



This result can be appeared in the electrode Pd or Ti when the electrolysis of heavy water contains some ordinary water. Both ${}^4\text{He}$ and ${}^3\text{He}$ had been observed in our past experimental research [6,7].

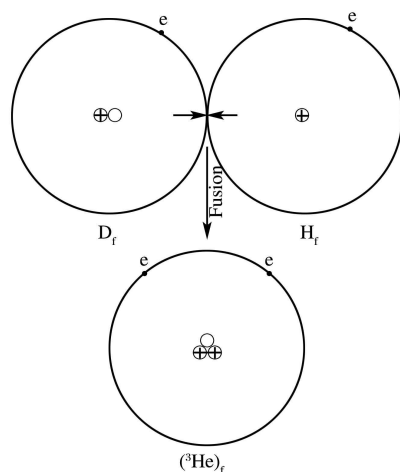


Figure 4: Full atomic fusion between deuterium atom and hydrogen atom

5 The ionic crystals PdD and TiD₂ are two very good cold fusion materials

From Fig. 1, we can see that the crystal Pd will be changed into ionic crystal PdD if its all interstitial positions are filled with deuterium atoms by long time electrolysis of heavy water, and the deuterium atom D will be changed into a larger spherical ion D⁻ as shown in Fig. 5 [3]. The binding energy between its deuteron and valence electrons is greatly decreased and the deuteron is highly mobile in the sphere. The repulsive force between two neighboring deuterons immersed in their neighboring two spheres is greatly decreased due to the screen effect of their valence electrons. Therefore the close collision between the deuterons and nuclear fusion will be raised easily. In the same time, we can see from Fig. 1 that every interstitial atom is surrounded by twelve interstitial atoms. The nuclear fusion will be raised more easily. Therefore the ionic crystal PdD is a very good cold fusion material. In our past experimental research, we find that the ionic crystal TiD₂ is also a very good cold fusion material. We may explain it with the same theory [3].

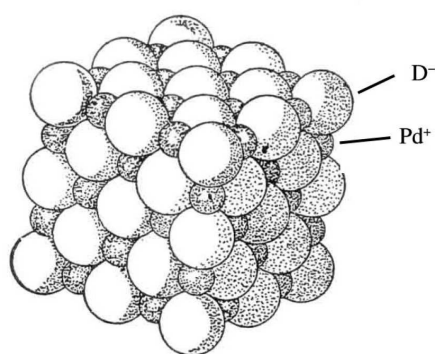


Figure 5: Ionic crystal structure of PdD

6 Conclusion

Through a deep analysis for the primary theory of cold fusion mechanism proposed early in 1989 by us, we find that the cold fusion between two neighboring full deuterium atoms in the interstitial positions of a palladium crystal can be raised. The fusion produces full atom (⁴He)_f and excess heat *Q* in the crystal. If the deuterium atom will be changed into negative ion of the ionic crystal when it penetrate in a crystal and change the crystal into ionic crystal, then the cold fusion will be raised more easily, as in the case of PdD or TiD₂. The ionic crystals PdD and TiD₂ are two very good cold fusion materials. ³He is a very important nuclear energy material. We can get it from the full atomic fusion between deuterium atom and hydrogen atom.

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