

Thermodynamic Theory of Cold Nuclear Fusion (C.N.F)

Zhongliang Zhang

Institute of Chemistry, Academia Sinica Beijing, 100080,
China Fax: 01-2569564

and

Shu-I Liu* University of Science and Technology of China

* *Address for Correspondence:*

Prof. Dr. Shu-I Liu 111 bulding 15, Zhongguancun, Beijing
100080 China Phone: Beijing 2561790

Sept. 29, 1992

A new discipline known as STATE-FIELD THEORY OF THERMODYNAMICS (S-F. TOT) had been established in the period (1979-1991) by Shu-I Liu [1-5] [10].

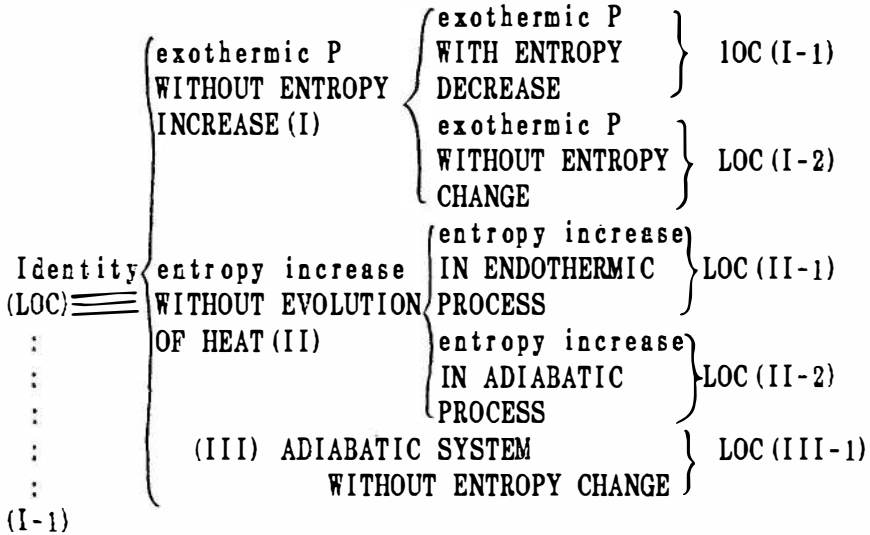
In the present paper, (S-F. TOT) was applied to set up a strict thermodynamic theoretical foundation for the problem of COLD FUSION [6-9].

(I) THE NEW SECOND LAW OF THERMODYNAMICS, THE (law of Coupling) = (LOC)

In article [10], the first law was used to prove the qualitative existence of entropy S ($dS = 0$, when $\delta Q_R = 0$) without knowing the dS equation. This makes it possible to establish a new second law of thermodynamics, the Law Of Coupling (LOC) [1] [2], which states:

"It is impossible for a simple system to approach a high entropy state from a low entropy one with evolution of heat at the same time! " } (Liu' s LOC)

This statement is identical with() its 3 branches (I) (II) (III) and 5 small branches as shown by (Liu' s Branch Theory of LOC), Equation (I-1) wherein P Process)



Cold Nuclear Fusion belongs to LOC (I-1): } (I-2)
 (CNF) is an EXOTHERMIC PROCESS
 with ENTROPY DECREASE.

Entropy S is an extensive function, its value is

proportional to the number of moles (n): n=2 for the reactants (A+B); and n=1 for the product AB with mass defect:

$$\text{LOC (I-1)} \dots \left\{ \begin{array}{l} \text{A+B} \rightarrow \text{AB with mass defect} \\ \text{(mass defect)} \rightarrow \text{(heat < 0)}; \\ S_{\text{A+B}} > S_{\text{AB}} \end{array} \right\} \dots \text{(I-3)}$$

(II) DISSIPATION CRITERIA FOR COLD NUCLEAR FUSION (CNF):

It was proved by using LOC for the process of irreversible charging of an electric cell:

$$(\Delta Z_{\text{TP}} = -A' - \Delta A) / \text{mole} \dots \text{(II-1)}$$

This is the first two laws of thermodynamics for this irreversible cell process wherein:

$$\Delta Z_{\text{TP}} = \left. \begin{array}{l} \text{(increase of free energy)} \\ \text{produced by the charging work} \\ A' < 0 \text{ done to the cell} \end{array} \right\} \dots \text{(II-2)}$$

The meaning of the above two equations is:

Bra { In the process of charging, the work input to the cell, A' is converted into the increase of free energy, $\Delta Z_{\text{TP}} > 0$;
Due to IRREVERSIBLE NATURE of the process, the work input A' cannot be completely converted

into free energy increase $\Delta Z > 0$,
 PART OF A' IS DISSIPATED AS HEAT: } ket... (II-3)
 (Heat Dissipation) = $\Delta^A > 0$

The exists a (CRITICAL VALUE OF Δ^A) = Δ^A_c , such that
 the following (CRITERIA FOR CNF) hold:

$$(1) \left\{ \begin{array}{l} \text{If: } \Delta^A \geq \Delta^A_c, \\ \text{Then:} \\ \text{(CNF) occurs} \end{array} \right. ; (2) \left\{ \begin{array}{l} \text{If: } \Delta^A < \Delta^A_c, \\ \text{Then: (CNF)} \\ \text{cannot occur} \end{array} \right. \dots (II-4)$$

Equation (II-4) seems to explain the experimental facts published by some authors. However, more experiments are seriously needed, especially the method of experiment and treatment of the results need serious considerations.

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