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1. THINKING ABOUT THE DEVELOPMENT OF COLD FUSION RESEARCH[*]

Makoto Okamoto[+] (Tokyo Institute of Technology)

Professor Hideo Kozima is a scientist who specializes in physics of matter. Since he usually takes a cool view of things, I can hardly imagine what led him to start the study of the mysterious world of cold fusion.

The phenomenon with earthly nomenclature “cold fusion” aroused considerable interest in various fields, resulted in criticism from the researchers consists of from individuals to people who work for public institutions. Professor Kozima must have been observing the progress calmly with the viewpoint of cool-headed scientists in the uproarious secular world.

Prof. Kozima showed up in this mysterious world in the phase most people had lost interest and were seeking other concerns. He may have found pleasure in revealing one of new phenomena, which have been much easily denied and disappear in those days. Science in the latter half of the 20th century is overwhelmed by mammoth-project experiments. Each scientist in the project is forced to conduct his study on the bases of such experiments, which prevents the scientists from developing unprecedented conceptions. Under these circumstances, Prof. Kozima was probably enchanted with the study of cold fusion as the most mysterious phenomenon.

Prof. Kozima, who established the solid foundation beyond his special domain, has analyzed the experimental data sets of this phenomenon with care and pursued investigations to find some physical clues. The book shows his thought processes. It is quite hard to select a theme worthy of study in this phenomenon. That is because there exist various approaches to the theory. There have been seen data full of variety including some unfinished poor theses and reports until now. I have long abandoned my efforts to find a

theme. He completed the book because of his enthusiasm to establish a system in this confusion. Through his analysis he is trying to consolidate the various results presented as experimental truth and explain them theoretically. He selected the objects of the study by his scientific sensibility. However, I have to add that my viewpoint is not always the same as that of Prof. Kozima's.

Prof. Kozima is also proficient in Russian, often attends the Russian Conference, and is well informed on the studies in Russia and surrounding countries. The description of the researches in these countries introduced in this book is particularly useful as valuable materials for research. The last material, which is referred to in the book, is the paper published at the ICCF6 held in Toya, Hokkaido in the middle of October 1996. Since then some study groups have been developing the related studies based on scientific thoughts and methods. Prof. Kozima shows his own accomplishment, which isn't necessarily a common concept among the related research scientists. I can imagine that Prof. Kozima is now concentrating his efforts on another new paper in his quiet office at Shizuoka University. Finally I wish Prof. Kozima's devoted labor would be a key to resolve the confusion in this mysterious phenomenon.

December 1996

In my laboratory at Ohokayama hill (Tokyo Institute of Technology),

Meguroku, Tokyo.

{*} This essay was written in Japanese and dedicated to the Japanese version of this book. H. Kozima did Translation into English after the author's unexpected death and published in *Discovery of the Cold Fusion Phenomenon - Development of Solid State-Nuclear Physics and the Energy Crisis in the 21st Century* -, p. 302, Ohtake Shuppan Inc., Tokyo, Japan (1998).

{+} Dr. Makoto Okamoto died of lung cancer on May 4, 1998 at his age of 60 as a

Professor of Tohoku University where he moved to in April, 1997. He was a heavy smoker and used to tell that every smoker suffers not always from a lung cancer. Really, it is a matter of probability or qualitative reproducibility if one of smokers suffers from lung cancer or not, as a problem of statistics. I have to say, however, the death of Dr. M. Okamoto was too early and sad unexpected but definite event for me and for CF research community. I would like to express my condolences to Dr. M. Okamoto in heaven on his bereavement.

2. On The Cold Fusion Researches{*}

Makoto Okamoto

{*} This essay was written as the foreword to the special issue "Cold Fusion" of *International Journal of the Society of Materials Engineering for Resources* (Japan) **6-1** (1998).

Makoto Okamoto (Tohoku University)

Energy is the most important source for human life. Only the nuclear fission energy is non-fossil energy in our long-long history. We know the second atomic energy can be obtained by Nuclear Fusion reaction of the hydrogen isotopes. The study and technological development of the nuclear fusion energy have been carried out from almost same time as of the nuclear fission energy development. Unlike the nuclear fission energy, the nuclear fusion energy has been used only as hydrogen bomb. The nuclear fission energy can be liberated in the very simple system.
The core of the nuclear fission power plant consists of solid uranium fuel and liquid moderator/coolant in the room temperature. It can be easily realized by the special property of the neutron. The nuclear fission energy should be recognized as [very lucky energy] because every thing in the nuclear fission power plant can be performed in condensed phases at the room temperature. We have to know that we had nuclear fission reactors naturally occurred on the Earth. Unfortunately, the nuclear fusion reactions can be taken place in the plasma phase of the hydrogen isotopes, as in the Sun.

The [Test tube Nuclear Reaction] concept by Fleischmann and Pons consisted of the materials in the condensed phases at the room temperature. If ¥dee ¥haihun ¥dee fusion reaction takes place in such a system, we can have a possibility to realize a nuclear fusion reactor similar to the lucky nuclear fission reactors. Their concept was completely unacceptable so far to the today's physics. But we never forget a phrase [What we know is like a mole hill, but what we do not know is like a mountain].

Many researchers have carried out many, many replication trials and several approaches have been tried to find the evidences of the *d*–*d* nuclear reactions

in condensed materials. Even their hands could not succeed the replication of the Fleischmann/Pons phenomena. They have included Fleischmann/Pons reported different results in every time. The possible reason why the replications were unsuccessful may be that the conditions of the experimental could not be reproduced completely, because we must obtain the same results, when we can replicate the experimental conditions completely.

From the very poor reproducibility, the cold fusion phenomena had to be recognized as tremendously complicated phenomena overlapped strongly in chemistry, electrochemistry, nuclear chemistry, nuclear physics, metallurgy, calorimetry, and so on. Not a few researchers have found that reproducibility to catch the evidences of the anomalous phenomena were so poor. In this stage, they should know that the anomalous phenomena is governed by many complicated parameters, and should check the reproducibility of their experimental conditions as severe as possible. Unfortunately, most of the researchers did not care of the reproducibility of their experimental conditions. They were longing to find more intense evidences by modifications of the parameters with very poor scientific bases.

If, like Fleischmann and Pons concept, the anomalous phenomena are caused from the *d*–*d* nuclear fusion reactions, the distance between D and D atoms has to be tremendously shortened as expected in muon-catalyzed fusion model. But, there has been no models to accumulate deuterium with anomalously high density in Pd cathode to increase the reaction probability of the *d*–*d* nuclear fusion. The anomalously high density of the deuterium is only the base to find a way to use word of [fusion] in their discussions.

Moreover, there have been not a few reports in which instead of deuterium, protons induced some anomalous phenomena, such as very big excess heat generation, nuclear transmutations, etc. Even if the results reported were true, we cannot find any bases by which the results could be explained scientifically. In these cases, they have to obtain the same results by replication of their experiments. With poor reproducibility, nobody can approve the occurrence of the anomalous phenomena.

Experiment is only one method to find new phenomena and to verify the new phenomena to be true. To verify, we should obtain the same results with same conditions, and we should use the approved techniques in every issue. In the basic research program of the New Hydrogen Energy Research Project, there have been a series of experimental studies based on the [classic approaches], and found very interesting facts. These studies may be good examples to wipe out the dark cloud over the so-called cold fusion researches. I still now have an activity to find a possibility to utilize the nuclear fusion energy in some lucky concept like the nuclear fission energy systems.

Preface

The 6th International Conference on Cold Fusion (ICCF6) was held at Lake Toya, Hokkaido, Japan, on October 13th - 18th 1996, with 179 participants registering from 17 countries. 43 oral presentation papers and 77 poster presentation papers were selected out of more than 160 abstracts originally submitted. The Proceedings, ***"PROGRESS IN NEW HYDROGEN ENERGY"***, has been edited as the document of the Conference.

The Local Organizing Committee carried out a series of intensive discussions on the scope of the conference, and decided that it should provide an international forum for discussion of the most recent and academic aspects of the research.

Following the scope, the Technical Program Committee spent many hours reviewing and selecting the papers that were to be presented in the Oral and Poster Sessions. Mainly young researchers performing highly scientific activities were selected, based on their submitted abstracts and the recommendations by related senior scientists, and approximately 30% of the submitted abstracts were rejected. Severe discussions were also made in selecting the presenters that were to be supported financially by the Basic Research Program of the NHE Project, and more than 20 researchers received financial support to attend the Conference. The Local Organizing Committee also planned a technical tour which was a new attempt in the history of ICCF. The tour to the NHE Sapporo Laboratory was realized on October 18th by the generous assistance of Dr. N. Asami (Vice-Chairperson) and his staff.

The topics for papers were arranged into 5 fields : (1) Excess Energy Phenomena in Deuterium/Metal Systems, (2) Correlation Between Excess Energy and Nuclear Products, 3) Nuclear Physics Approaches, (4) Material Science Studies, and (5) Innovative Approaches. All topics covered both experimental studies and theoretical studies. The topics also formed a new base in realizing the scientific and academic conference in the so-called cold fusion research field.

The Conference was formed by two sessions : the Fundamental Session and the Special Session, and both sessions consisted of several sub-sessions. The Fundamental Session had 7 sub-sessions; 1 : Helium and Heat Correlation (5), 2 : NHE (5), 3 : Excess Heat (7), 4 : Material Science Studies (5), 5 : Nuclear Physics Approach (5), 6 : Innovative Approach (2), and 7 : Excess Heat and Nuclear Products (5). The Special Session had 4 sub-sessions; 1 : Russian Activities (1), 2 : Indian Activities (1), 3 : CETI (Paterson Cell) (2), and 4 : Nuclear Transmutation (5). The numbers in parenthesis represent the numbers of oral presentations in each sub-session.

77 abstracts were accepted for poster presentation in the two sessions. The two-minute Poster Previews were successfully carried out before the poster sessions. All poster presentations were displayed on the poster boards for one day to provide adequate time for intensive discussions.

Preface

The Proceedings consist of two parts : the first part for the Fundamental Session and the second part for the Special Session. The volume for each paper was determined in accordance with the academic journals in the science field. Rather than attempting to personally introduce the papers myself, I believe it would be best for each one of you to evaluate and find the significance of each papers yourself. As seen in the Proceedings, recent advances in this extremely wide and intensive research field, from nuclear physics to material science, has made various scientific discussions possible in this attractive but long neglected field of study.

Finally, I would like to express my heartfelt appreciation to all ladies and gentlemen who strongly collaborated in realizing this wonderful scientific conference, especially to the participants, New Energy and Industrial Technology Development Organization, The Institute of Applied Energy, New Hydrogen Energy Laboratory, Technical Program Committee and Convention Linkage, Inc.

Chairperson, Prof. Makoto OKAMOTO,
Local Organizing Committee
The Sixth International Conference on Cold Fusion