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CFP (Cold Fusion Phenomenon) stands for

"Nuclear reactions and accompanying events occurring in open (with external particle and energy supply), non-equilibrium system composed of solids with high densities of hydrogen isotopes (H and/or D) in ambient radiation" belonging to Solid-State Nuclear Physics (SSNP) or Condensed Matter Nuclear Science (CMNS).

This is the *CFRL News* (in English) No.92 for Cold Fusion researchers published by Dr. H. Kozima, now at the Cold Fusion Research Laboratory, Shizuoka, Japan.

This issue contains the following items:

1. From the History of CF Research (6) — The First Confirmation of Localized Nuclear Reactions in CFP by M. Okamoto et al. (1994)

It is a big and controversial problem where the nuclear reactions of the cold fusion phenomenon (CFP) occur in CF materials such as PdD_x(Li) (x~1) and NiH_x(K, Rb) (x~1) in relation to the fundamental nature of the CFP. The first concrete answer to this problem was given by Okamoto et al. in 1993 and 1994 [Nakada 1993, Okamoto 1994].

1.1 Confirmation of Localized Nuclear Reactions by Okamoto et al.

Let us cite a sentence from the paper by Nakada et al. presented at ICCF3, at first:

"The depth profiles of Li, D and Pd were observed by SIMS technique for several Pd test pieces cut from the Pd electrodes employed in the study of neutron emission from the heavy water electrolysis using Pd-D_2O-LiOD system. The depth profiles can be classified into two types; one is the profile with a structure and the other is the monotonous profile. The former was observed on the Pd test piece from the Pd electrode with neutron emission, while the latter was from the Pd electrode without neutron emission." [Nakada 1993 (p. 586)]

They succeeded their experiment and published a more detailed result at ICCF4 almost a year later:

"The examples of the depth profiles of D, Li, Pd, Si, and Al are illustrated in Fig. 1.

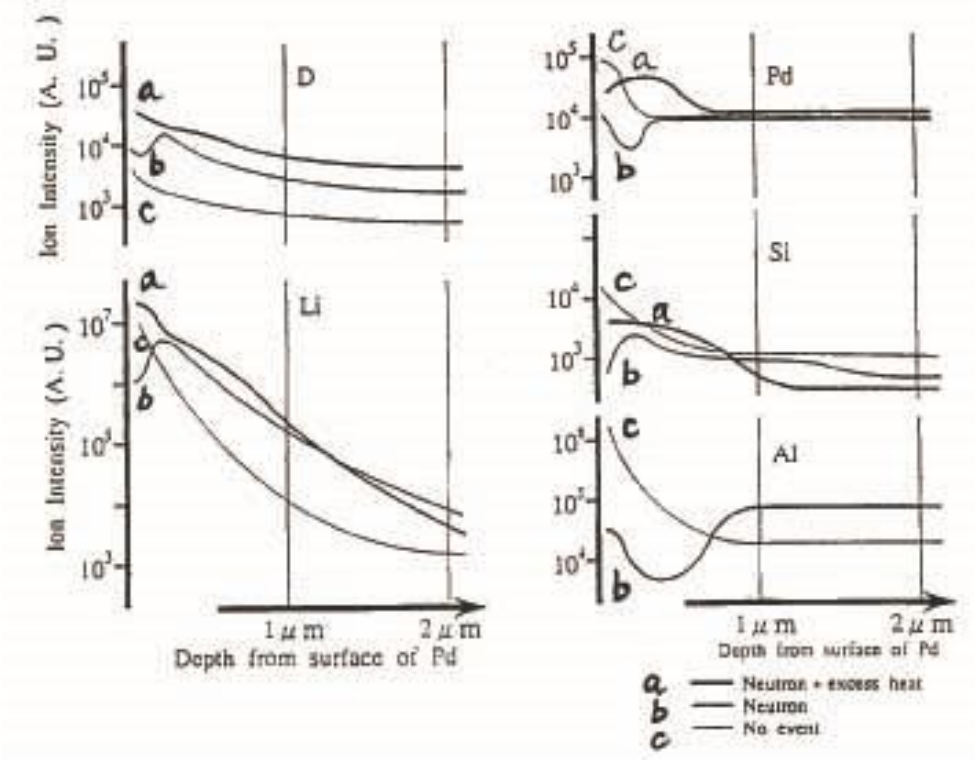

Fig. 1 Examples of depth profiles for each element.

The profiles with bold line represent the depth profiles of each elements obtained from the Pd sample with the nuclear effect of neutron emission and excess heat generation, the medium line for Pd sample with only neutron emission, and the chain-line for Pd sample with no nuclear effect. The curves shown in these figures are normalized to the secondary ion intensity of Pd obtained in each analysis run to carry out the discussion on the concentrations on the same elements. Evidently from the figures, the depth

profiles of the elements with no nuclear effects are monotonous as expected from the electrochemical point of view. (2) While, the depth profiles with some nuclear effects have some of irregular structures, especially in the surface within 2 μm for every element. The depth profiles of lithium and deuterium are very similar in each. This fact indicates that there is a very strong chemical relation between the lithium behavior and the deuterium behavior as discussed in the previous paper." [Okamoto 1994 (p. 14-2)]

We have explained the decrease of $^{27}_{13}$Al and increase of $^{28}_{14}$Si observed by Okamoto et al. as a result of the reaction followed by a beta-decay;

$$^{27}_{13}\mathrm{Al} + n \rightarrow {}^{28}_{13}\mathrm{Al}^* \rightarrow {}^{28}_{14}\mathrm{Si} + \mathrm{e}^- + \underline{\nu}_\mathrm{e},$$

where $\underline{\nu}_\mathrm{e}$ represents an electron neutrino [Kozima 1996c] [Kozima 1998 (Sec. 11.11e)].

This paper ([Okamoto 1994]) is posted at CFRL website after the CFRL News No. 92: http://www.geocities.jp/hjrfq930/News/news.html

The essays by Dr. Makoto Okamoto are posted at the CFRL website: http://www.geocities.jp/hjrfq930/FTEssay/Essays/Okamoto.htm

Almost at the same time, Bockris et al. determined distribution of transmuted nuclei in surface layers of a few micrometers [Bockris 1995]. The essay "*Cold Fusion 1999*" by Dr. J.O'M. Bockris is posted at CFRL website: http://www.geocities.jp/hjrfq930/FTEssay/Essays/Bockris.htm

1.2 Meanwhile Many Researchers Expected the Localization of Nuclear Reactions in the CFP

It is interesting to recollect the transition of the interpretation of events related to the cold fusion phenomenon (CFP) from the first stage of the CF research in the development of the research. In the pioneering experiment performed by Fleischmann et al., they concluded that the nuclear reactions (*d-d* fusion reactions and other unidentified reactions) induced the products they observed had occurred in the bulk of the specimen;
"(a) Excess enthalpy generation is markedly dependent on the applied current density (i.e. magnitude of the shift in the chemical potential) and is proportional to the volume of the electrodes, i.e. we are dealing with a phenomenon in the bulk of the Pd electrodes." [Fleischmann 1989 (p. 304)]

In the process of development, researchers recognized importance of the surface layer of CF materials. We do not know why but there are many mentions in CF papers before the works by Okamoto et al. was published. For example, there are following sentences in the paper by McKubre et al. discussed in the previous News No. 91:
"This observation raises the interesting possibility that one or more species, other than

deuterium, are required to be present in the cathode in order to observe excess power, species which are not present initially and are thus required to diffuse into the cathode, presumably from the electrolyte. Analyses of used cathodes have revealed the presence of several light elements in the near-surface region (to a depth of several microns); in particular, lithium." [McKubre 1993 (p. 18)]

The role of the surface layer, however, seems to be considered as subsidiary as above sentence shows and also the following sentence by Okamoto et al. shows:

"The process of anomalous accumulation of deuterium was discussed based on the formation of Pd-Li intermetallic compound in the surface area of Pd electrode." [Okamoto 1994 (p. 14-7)]

In this period, there is an interesting mention on the role of neutrons on the appearance of Ag and Au in the surface of Pd cathode by Dash et al. [Dash 1994]:

"Palladium cathodes from two experiments were analyzed microscopically after electrolysis in acidified light and heavy water. For both experiments, more excess heat had occurred in the heavy-water cell than in the light-water cell during electrolysis. For the first experiment, there were localized concentrations of Au detected in areas of the high-current density on both cathodes; greater concentrations of Au were found on the cathodes from the heavy-water cell. For the second experiment, there were concentrations of Ag detected near sites of surface melting on the cathodes from the heavy-water cell. Although occurring in only a small fraction of cathodes, these unexpected elements correlate roughly with measured excess heat and may have arisen through transmutation caused by neutrons from nuclear fusion reactions." [Dash 1994]

We can add another example of nuclear transmutations. In the case of Ni mesh cathodes with light water based rubidium salt electrolytic cells, Bush et al. observed nuclear transmutations from Rb to Sr as discussed in the CFRL News No. 89:

"Appendix A provides an interpretation of these from the standpoint of hypothetical strontium production. An interesting finding from the standpoint of the CAF Hypothesis [1,3,6] is the fact that, within experimental error, the ratio of the line height for mass number 86 to that for 88 was the same as that for the ratio of the rubidium signals at masses 85 and 87." [Bush 1994 (pp. 346 – 347)]

This data was explained by our TNCF model [Kozima 1996a, 1998 (Sec. 11.11b)]

The excellent analysis of Pd cathode provided by Fleischmann et al. to fined ^{4}He in the surface layer of a width of about 40 μm by Morrey et al. had been discussed already in our CFRL News No. 88. It is possible to say that this data obtained by Morrey et al. was the first determination of the local nature of the CFP from our present knowledge as

we had discussed there. We have explained their experimental result by our TNCF model where ^{4}He was generated by Li-*n* reactions in the surface layer $PdLi_x$ [Kozima 1996b, 1997, 1998 (Sec. 11.8a), 1999] as suggested by the experimental data obtained by Nakada et al. and Okamoto et al.

1.3 Investigations of Nuclear Reactions at Surface Layers have been Extensively Performed with Various CF Materials

In the stream of these investigations of nuclear reactions in the surface layers, it should be emphasized that there are a few researchers who pursued the nature of these reactions in relation to the cold fusion phenomenon (CFP). T.O. Passell is one of them and has investigated nuclear transmutations of minor elements in surface layers of cathodes for several years [Passell 1996, 1998, 2002, 2006]. His data sets are fundamentally explained by our TNCF model and an analysis was given in our paper [Kozima 1996d] and book [Kozima 1998 (Sec. 11.11d)].

We have discussed the localization of nuclear reactions in the cold fusion phenomenon (CFP) already at JCF Meeting and explained almost all experimental data sets by our TNCF model [Kozima 2011a]. The papers by Miley et al. [Miley 1996, 1997], Enyo et al. ([Mizuno 1996a, 1996b] and [Ohmori 1996, 1997, 1999], Qiao et al. [Qiao 1997], and Iwamura et al. [Iwamura 1998, 2005, 2006a, 2006b, 2006c] have been explained by TNCF model and summarized in the above paper [Kozima 2011a].

The essay "*Open Minded Attitudes to the Science*" by Dr. Michio Enyo is posted at the following CFRL website:
http://www.geocities.jp/hjrfq930/FTEssay/Essays/Enyo.htm

Lastly, I want to give a short glimpse at experiments with hydrogen non-occlusive metals. It is, at first sight, impossible to obtain any nuclear reactions from metals that do not occlude hydrogen isotopes. However, there are several positive experiments where observed excess heat and/or nuclear transmutation with Au, W and Pt electrodes. Ohmori et al. observed nuclear transmutations with gold (Au) and tungsten (W) electrodes [Ohmori 1996, 1997, 1999] and Noble et al. observed almost the same amount of excess heat with a Pt cathode coated with Pd and sulfate as that with Pd cathode [Noble 1995].

These data sets together with experiments with thin layers of hydrogen occlusive metals used by Miley et al., Iwamura et al., and Celani et al. [Celani 2010] are suggestive to consider where the CFP occurs in CF materials. The last experiment by Celani et al. was successfully analyzed by the TNCF model [Kozima 2011b].

It should be added an important contribution by Szpak et al. in the SPAWAR Systems Center San Diego. They noticed importance of electrode-electrolyte interface on the cold fusion phenomenon (CFP) and investigated various features of the CFP with electrodes of Ni, Au and Cu co-deposited with Pd-D on their surface [Szpak 1992, 1994, 2004, Mosier-Boss 1999].

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Sections relevant to this analysis are posted at following pages of the CFRL Website:
http://www.geocities.jp/hjrfq930/Books/bookse/bookse01.html
The "References" in this book [Kozima 1998] is posted at the Cold Fusion Research Laboratory (CFRL) Website;
http://www.geocities.jp/hjrfq930/Books/bookse/bookse.html

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2. D.J. Nagel "Lattice-enabled Nuclear Reactions in the Nickel and Hydrogen Gas System" *Current Science*, Vol. 108, No. 4, pp. 646 – 652 (2015)

Dr. D.J. Nagel published his review paper on the present status of the application of the CFP in the *Current Science* Vol. **108**, pp. 646 – 652 (2015). The paper is possible to download from the *Current Science* website;

http://www.currentscience.ac.in/Volumes/108/04/0646.pdf

We cite the abstract of the paper below.

Abstract

Thousands of lattice-enabled nuclear reaction (LENR) experiments involving electrochemical loading of deuterium into palladium have been conducted and reported in hundreds of papers. But, it appears that the first commercial LENR power generators will employ gas loading of hydrogen onto nickel. This article reviews the scientific base for LENR in the gas-loaded Ni–H system, and some of the tests of pre-commercial prototype generators based on this combination.

By the way, we have given a comment on the E-CAT from our point of view already in the *CFRL News* No. 83 (2013. 12. 10), which will be helpful for people who are interested in the application of the CFP.

3. Obituary: Alexander Borisovich Karabut (– 2015. 3. 15)

We had a sad news that Dr. Alexander B. Karabut passed away on March 15, 2015 from Dr. Yuri N. Bazhutov as cited below. Alexander was an excellent experimentalist published many excellent papers co-authored with I. Savvatimova and a good-natured gentleman in private communication with me. I have had many pleasant times with him in Moscow and Sochi at Russian Conferences on the Cold Fusion and Nuclear Transmutations and in many cities in the world at ICCF. I condole with his family and colleagues on Alexander's death.

Dr. Alexander Borisovich Karabut
(– 2015. 3. 15)
(Photo by H. Kozima on April 11, 1995)

Mail from Dr. Y.N. Bazhutov:

"Dear colleagues!

With a big regret has to tell you that yesterday (15.03.15) after a short illness (stroke) in hospital Karabut Alexander Borisovich died. He was:

Our Veteran and one of Leaders Researchers in Russia of Cold Nuclear Transmutation,

The Winner of the International award HTYa of J. Preparata for 2007,

The Winner of the State Award USSR for 1982,

Member of Coordinating Council on the Problem of "Cold Nuclear Transmutation" (RFO),

Member of Editorial Board RCCNT&BL-(16-21) & constant participants of almost all RCCNT&BL,

PhD, Senior Researcher of NPO Luch.

Yuri Nikolaevich Bazhutov"

[Postscript on April 15, 2015)]

An introduction to the late Alexander Karabut was written by M. Macy and published in the *Infinite Energy*, Issue 120, March/April 2015.

Alexander Karabut: A Russian Scientist's – Tenacity and Contribution – by Marianne Macy

The article is posted at the *infinite energy* website:

http://www.infinite-energy.com/iemagazine/issue121/karabut.html