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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).

This is the *CFRL News* No.113 for Cold Fusion researchers published by Dr. H. Kozima, at the Cold Fusion Research Laboratory, Shizuoka, Japan.

This issue contains the following items:

1. **The three papers presented at JCF21 from CFRL were accepted for publication in the *Proceedings of JCF21* which will be issued in near future.**
2. **The International Conference, ICCF23, was held on Internet on June 9 – 11, 2021 in China.**
3. **My paper "The Cold Fusion Phenomenon – Nuclear Reactions in the CF Material at Around Room Temperature – " was published in *International Journal of High Energy Physics,* 8-1, pp. 1 – 12 (2021).**

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Future

We presented following three papers at the 21st Annual Meeting of the Japan CF-Research Society held on December 11-12, 2020 in Kyoto (on the Zoom platform) as announced in the CFRL News No. 111 (December 15, 2020) and No. 112 (March 20, 2021):

(1) **JCF21-2** H. Kozima, *Cold Fusion Phenomenon in the Composite CF Materials – Mixed Hydrogen Isotopes, Alloys, Ceramics and Polymers –*

(2) **JCF21-3** H. Kozima, *Cold Fusion Phenomenon in the Compound CF Materials – Effects of Interfaces –*

(3) **JCF21-4** H. Kozima, *Neutron Energy Bands in the Compound and Composite CF Materials – Speculation on the Bases of the TNCF and ND Models –*

They have been accepted to publication in the *Proceedings of JCF21* and will be posted at the JCF website shortly: http://jcfrs.org/file/proc_jcf.html

2. The International Conference, ICCF23, was held online on June 9 – 11, 2021 in China. http://ikkem.com/iccf-23_program.php

I have presented a paper "**A Sketch of the Solid State-Nuclear Sciences**" at this Conference and this paper has been posted at ICCF23-P-17.

Abstract of my paper to be submitted to the *Proceedings of ICCF23* is cited below.

"**Abstract**

Since the discovery of nuclear reactions in PdD_x alloys in 1989, there have been accumulated very many experimental data sets showing existence of nuclear reactions in materials composed of lattice nuclei of transition metals and occluded hydrogen isotopes (let us call them the CF materials, for short) resulting in various nuclear products such as transmuted nuclei, tritium, neutrons, and others accompanied with large excess energies at relatively low temperatures up to 1000 ºC (let us call these whole events the cold fusion phenomenon (CFP), for short). As the cause of these nuclear reactions in the CFP, we have to accept the existence of the interactions between nucleons in the CF material through the nuclear force (let us call this interaction the nuclear-force interaction, for short) recognized in the nuclear physics. Before the discovery of the CFP, existence of the nuclear-force interaction in solid state physics had been known only in limited phenomena as the neutron diffraction and the Moessbauer effect.

Even if the nuclear force has recognized as the cause of nuclear reactions observed in the CFP since its discovery in 1989, there should be its fingerprints in other phenomena in solid state physics and chemistry occurring in materials with similar compositions to

the CF material (let us call these materials the nuclear-solid materials, for short). Since the Graham's discovery of the absorption of hydrogen by palladium and palladium-silver alloys in 1866, the physics of the transition metal hydrides has shown a great development revealing various characteristics of the physics in them especially the extremely high diffusivity of hydrogen in metals and alloys (let us call this phenomenon as the super-diffusivity, for short). We have noticed the relation between the CFP and the super-diffusivity and explained some characteristics of the CFP using the data of the super-diffusivity. Thus, we may be able to expect that the nuclear-force interaction between lattice nuclei and occluded hydrogen isotopes will give explanations for some of the unsolved problems in the super-diffusivity in the solid state-nuclear physics.

On the other hand in the electrochemistry, there have been observed such wonderful events closely related to the interaction between the transition metals and the hydrogen at the electrode surface as the hydrogen electrode reaction (HER) and the underpotential deposition (UPD). There are many characteristics of the HER and UPD remaining unexplained for more than 80 years after the formulation of the problem in 1933 by A.N. Frumkin. In relation to the nuclear-force interaction recognized in the CFP, we can apply the same new concept to investigate the unsolved problems in the HER and UPD in the solid state-nuclear chemistry.

Furthermore, there have been discovered the exotic nuclei with a large unbalance of the numbers of protons and neutrons in the isolated nucleus in these 20 years. The halos observed in these exotic nuclei have shed light on the new features of the nucleon interaction in the isolated nucleus. We may expect existence of new features of exotic nuclei in the nuclear-solid materials where the lattice nuclei and the occluded hydrogen isotopes interact through the nuclear-force interaction.

These themes in the nuclear-solid materials pointed out above may be only a little examples in our knowledge in the solid state-nuclear sciences where the nuclear-force interaction between the occluded hydrogen isotopes and the lattice nuclei plays decisive roles. We want to throw light on the physics and chemistry of the nuclear-solid materials composed of specific elements (including transition metals) and occluded hydrogen isotopes by taking up the possible participation of the nuclear-force interaction which has not noticed its importance seriously until now.

In this paper, we point out several characteristic events in the super-diffusivity, HER, UPD, and the exotic nucleus in the nuclear-solid materials which seems to have close relations to the nuclear-force interaction noticed in the CFP."

3. My paper "The Cold Fusion Phenomenon – Nuclear Reactions in the

CF Material at Around Room Temperature – ” was published in *International Journal of High Energy Physics*, 8-1, pp. 1 – 12 (2021).

http://www.sciencepublishinggroup.com/journal/paperinfo?journalid=124&doi=10.11648/j.ijhep.20200703.11

The abstract of the paper is cited below:

“**Abstract**

Since the discovery of nuclear reactions in PdD_x alloys at around room temperature in 1989, there have been accumulated very many experimental data sets showing existence of nuclear reactions in solid materials composed of transition metals and occluded hydrogen isotopes (let us call them the CF materials, for short) resulting in various nuclear products such as neutrons, tritium, transmuted nuclei, and others accompanied with large excess energies at relatively low temperatures up to 1000 ºC (let us call these whole events the cold fusion phenomenon (CFP), for short). As the cause of these nuclear reactions in the CFP, we have to accept the existence of the interactions between nuclei in the CF material through the nuclear force (let us call this interaction the nuclear-force interaction, for short) recognized its existence in the nucleus in the nuclear physics.

We can classify the CF materials, i.e. materials where CFP occurs, into three groups: (1) metallic material including transition-metal hydrides (e.g. NiH_x, AuH_x) and deuterides (e.g. PdD_x, TiD_x), (2) carbonic material including hydrogen graphite (HC_x) and XLPE (cross-linked polyethylene) and (3) biological material including microorganisms, microbial cultures and biological tissues or organs. We will explain the characteristics of the CFP observed in each group in this paper.

The nuclear reactions in the CF material gives rise to production of new particles from neutron, triton, and new nuclei with proton numbers Z up to 83 accompanying enormous excess energy. In addition to these events, there occurs the stabilization of unstable nuclei, including the decay-time shortening of radioactive nuclei, which is especially interesting to apply it to treat hazardous nuclear waste produced by the nuclear power plant.

Finally, we give an overview of the CFP in relation to the solid state-nuclear physics and the solid state-nuclear chemistry where the nuclear-force interaction may play important roles to explain the riddles found but not given appropriate explanations in these old sciences hitherto.”