

Research Article

Decay-Instability of Transmuted Chemical Elements Obtained in LENR Experiment

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Abstract

It is well known that there are chemical element transmutations and its isotope composition transformations in LENR experiments [1], [2]. Time evolution of the transmuted chemical elements and their decay-instability have been studied in this work. New transmuted chemical elements (such as Fe, Cu, Ca...) were obtained from the initial pure cathode material Ni (99.99%) by heterogeneous plasma formation in a plasma-vortex reactor [1], [2]. The chemical compositions of the initial cathode material and the transmuted chemical elements were measured by the EDS method and the ICP-MS method. It was revealed that there is considerable decay-instability of the obtained transmuted chemical elements at the time. This instability is accelerated dramatically by weakly ionized non-equilibrium plasma (WINP) action. It was confirmed that relative concentration of the initial Ni-atoms (cathode material erosion) is not changed, but the relative concentration of the transmuted atoms is dramatically decreased by WINP's action. The author supposes that the theoretical model of bi-nuclear atom [4] can explain the obtained experimental results. Two-step transmutation method of the new chemical element creation in LENR experiment is proposed in this work at the first time. © 2022 ICCF. All rights reserved. ISSN 2227-3123

Keywords: LENR, ICP-MS, transmutation, time evolution, non equilibrium plasma

1. Introduction

There are many reports and much evidence connected with the observation of large bolide impacts on Earth's surface and large plasmoid interaction with mountain surfaces (for example, Tunguska's bolide, Chebarkulskii's bolide, Dalnogoorskii's plasmoid (mount 611), [3], and others). It was revealed that there is a transmutation of the initial chemical elements and their transformation in the soil samples obtained in the mountain region burned by bolide's explosion (or plasmoid's action). It is interesting to note that these soil samples after the plasmoid's action have strong magnetic properties. For example, a pure silicon sample has strong magnetic properties [3]. Note that these transmuted elements are not stable ones. It is revealed that there is decay instability of these elements by external heating of these samples up to a temperature of $T_a > 2000^\circ\text{C}$. The main task of this work is a study of decay-instability of the transmuted chemical elements obtained in *LENR plasma experiment* [1], [2].

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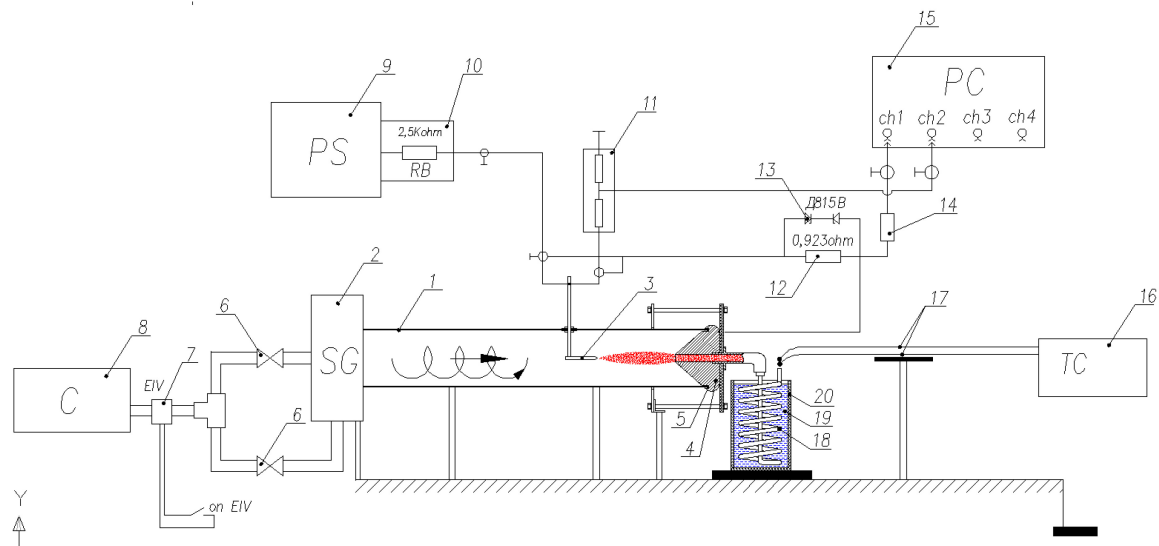


Figure 1. Schematic of the experimental PVR set up. 1 - quartz tube, 2 - swirl generator, 3,4 - electrodes, 6 - valve, 7 - gas flow meter, 8 - compressor, 9, 10 - power supply, 17 - thermocouple, 18-20 - water bath calorimeter.

2. Experimental Setup

Physical parameters and properties of a stable heterogeneous vortex plasmoid (plasma formation with eroded nano-clusters) created in high-speed swirl flow have been studied in our previous works [1], [2]. A schematic of the experimental plasma-vortex reactor (PVR) used in these works is shown in Fig. 1. This setup was described in our work [1], [2] in detail. The PVR's operation regime is shown in Fig. 2. One can see anode water steam injector (2), heterogeneous plasma (3) created by pulse-repetitive electric discharge and cathode (4) with of eroded metal nano-cluster cloud in this picture.

The typical experimental conditions were the following:

1. Mean excess power output 1 - 10 kW
2. Mean power input 0.1 - 1 kW
3. Testing gas mixture water steam + argon
4. Gas mixture mass flow <10 G/s
5. Combined discharge DC + high frequency discharge
6. COP 2 - 10.

A schematic of the experimental setup to obtain a transmuted chemical element sediment in the LENR plasma experiment is shown in Fig. 3. One can see plasma vortex reactor PVR (1) and water bath calorimeter (2) in this picture. The eroded dusty particles (eroded cathode material) are captured by water in this calorimeter. Then these sediment particles are evacuated from the bath and analyzed by the EDS-method and ICP-MS method. Photos of typical particles are shown in Fig. 4.

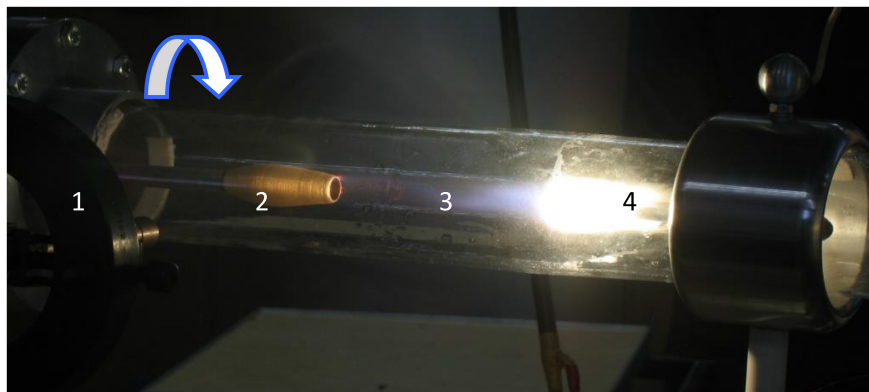


Figure 2. Plasma vortex reactor (PVR). Gas mixture $\text{Ar} : \text{H}_2\text{O} = 10 : 1$. Axial velocity V_x is closed tangential velocity V_t : $V_x \sim V_t \sim 30 \text{ m/s}$, $P_{st} \sim 1.5 \text{ Bar}$. 1-swirl generator, 2 - anode-water steam injector, 3 - electric discharge plasma, 4 - cathode with eroded metal nano-clusters.

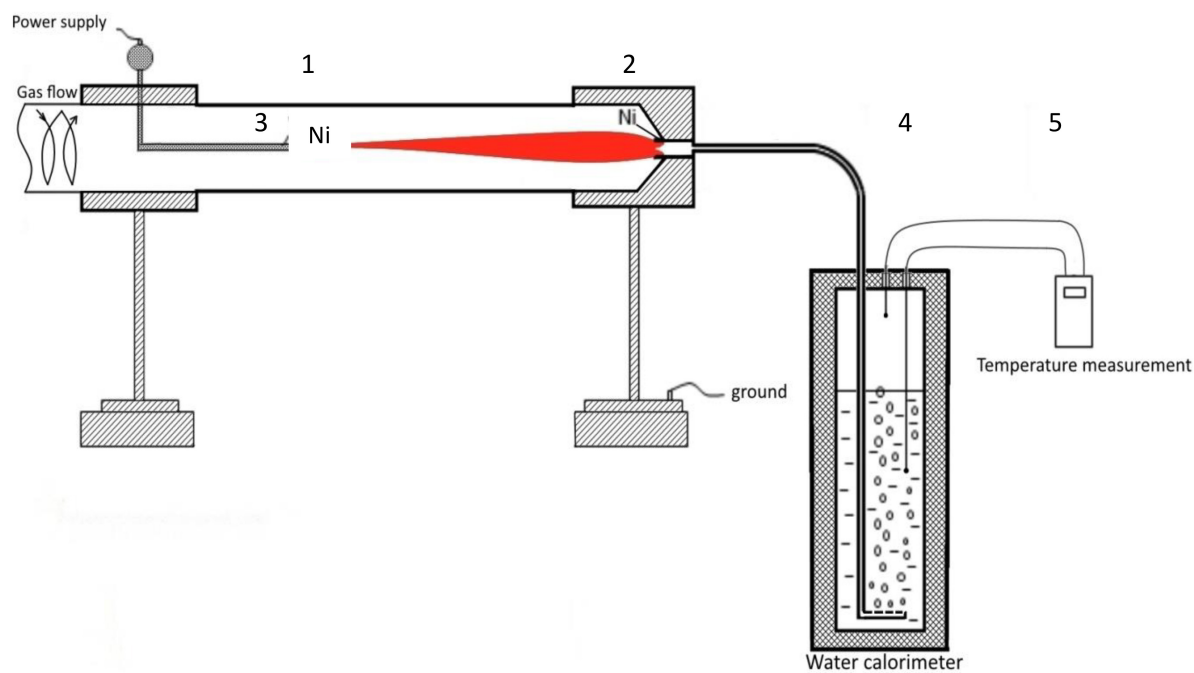


Figure 3. Schematic of the PVR with water calorimeter to obtain a sediment of eroded dusty particles in water. 1 - PVR, 2 - cathode (Ni), 3 - anode (Ni), 4 - water bath, 5 - thermocouple with recorder CENTER 306.

3. Main Experimental Results

Relative concentrations of new transmuted chemical elements inside eroded particles (sediment particles) are shown in Fig. 6 (right). All concentrations of these elements are normalized to their initial values. Note that pure Ni electrodes

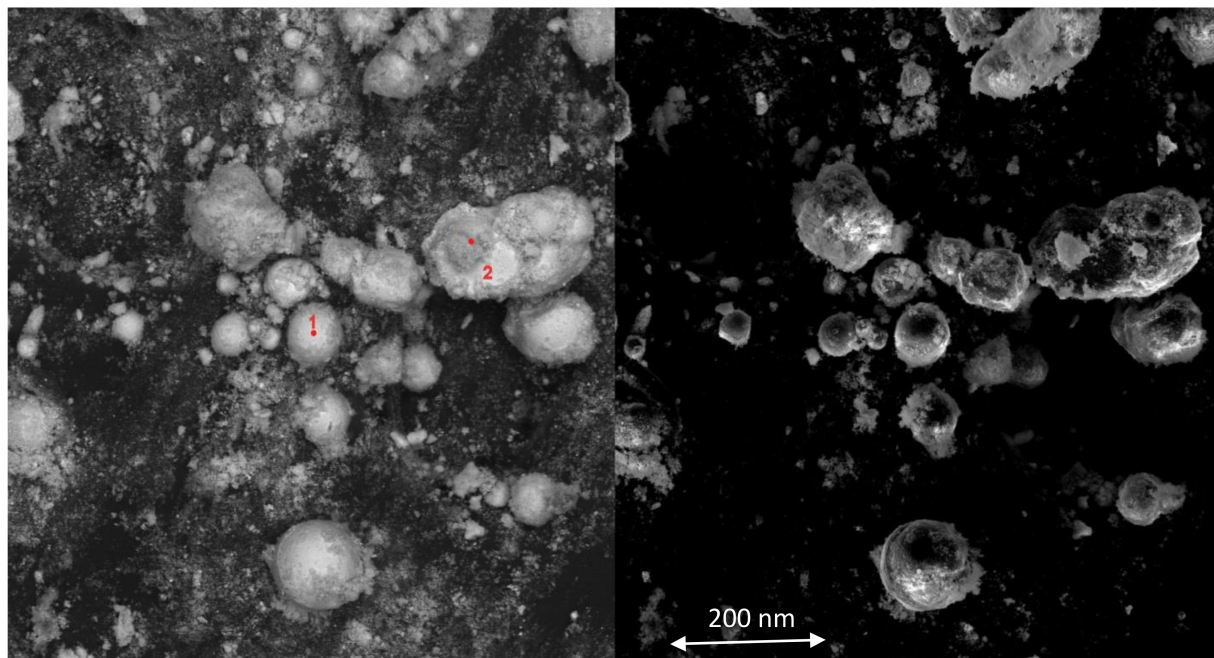


Figure 4. The typical eroded dusty particles obtained in the PVR with water bath calorimeter.

(99.99%) are used in the PVR. One can see that the relative concentrations of the following elements Fe, Cu, Zn are very high.

Then these sediment particles were acted by weakly ionized non-equilibrium plasma (WINP). A schematic of the experimental setup used in this experiment is shown in Fig. 5. An external magnetic field helps us to localize the exposed eroded particles with strong magnetic properties on the reactor's wall. This procedure increases plasma action on the eroded particle's surface. The magnetic field transforms a diffuse electric discharge to a constricted one. Argon injection (1) is used in this experiment to overcome possible oxidation of the tested eroded dusty particles at WINP's action.

Parameters of the power supply PS-1 were the following:

Mean discharge current $I_d \sim 64$ mA

Mean discharge voltage $U_d < 4.5$ kV.

Parameters of the plasma created by this PS were measured by optical spectroscopy method. These parameters obtained in this setup were the following:

Electron concentration $N_e \sim 10^9 - 10^{11} \text{ cm}^3$

Electron temperature $T_e \sim 1$ eV

Gas temperature $T_g \sim 500$ K in argon flow

Ionization level $N_e/N_a \sim 10^{-8} - 10^{-6}$.

The chemical compositions of the transmuted chemical elements after WINP's action were measured by the EDS method, ICP-MS method and optical spectroscopy method, Figs. 6, 7. It was revealed that there is considerable decay-instability of the new transmuted chemical elements at the time (without plasma action). The chemical analyses

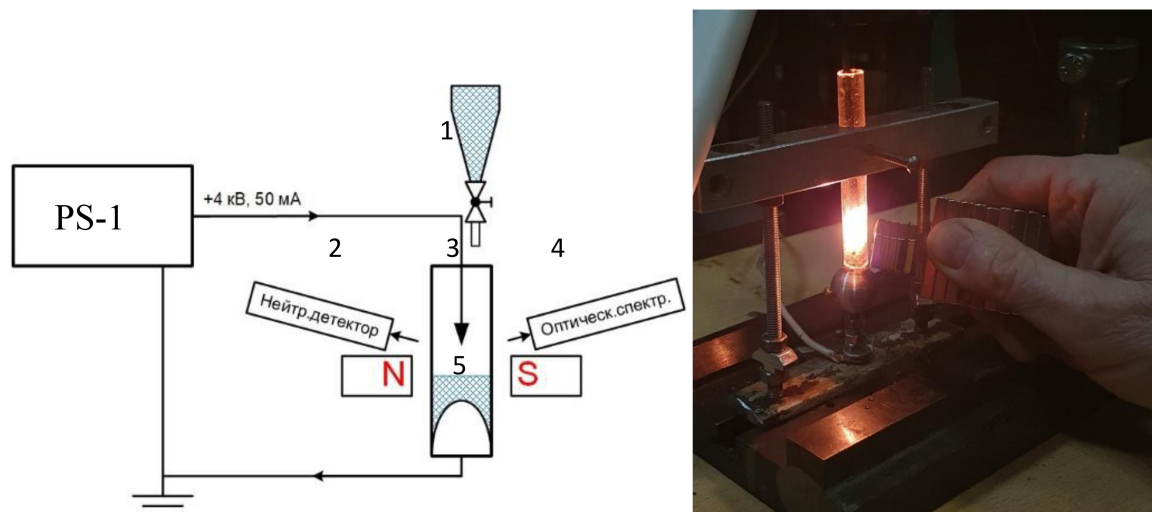


Figure 5. Schematic of the experimental setup to study WINP's action on the eroded dusty particles created by PVR (right). General view of experimental set up (left). 1 - argon injector, 2 - neutron detector, 3 - quartz tube reactor, 4 - optical spectrometer, 5 - tested sediment particles.

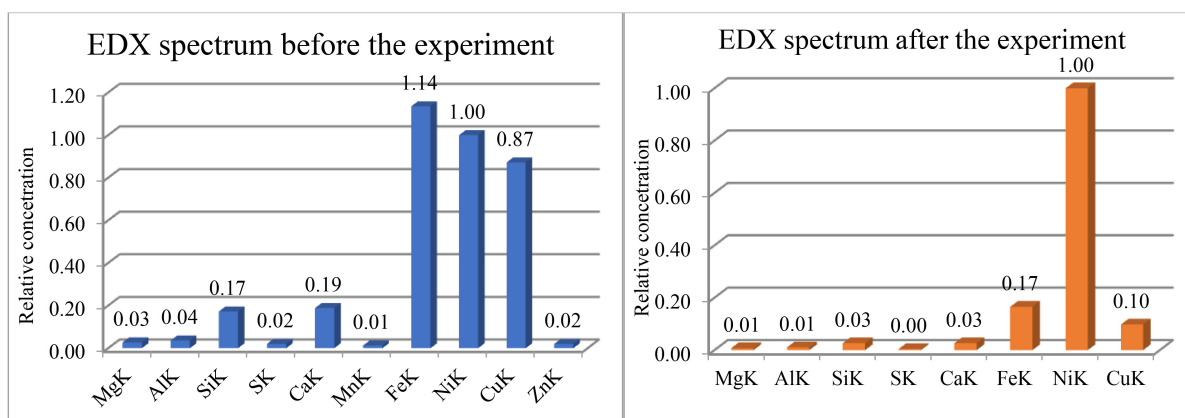


Figure 6. Relative concentrations of the transmuted chemical elements (eroded cathode particles) before WINP's action (left) and after its action (right).

were performed 1 week, 1 month, and 6 months after the experiment run. This instability is accelerated dramatically by factors of 10^3 - 10^6 by weakly ionized non-equilibrium plasma (WINP) action. It was confirmed that relative concentration of the initial Ni atoms (cathode material) is not changed in dusty eroded particles, but the relative concentrations of the transmuted atoms (Ca, Fe, Cu and others) are dramatically decreased, Fig. 6. An analogous result was obtained with Al-cathode (99.999%) exposed in the PVR with water steam, Fig. 7. One can see that the relative concentrations of transmuted chemical elements (such as Si, P, S, Cl, Ca, Fe, Zn) decreased dramatically from the WINP's action (Fig. 7, right).

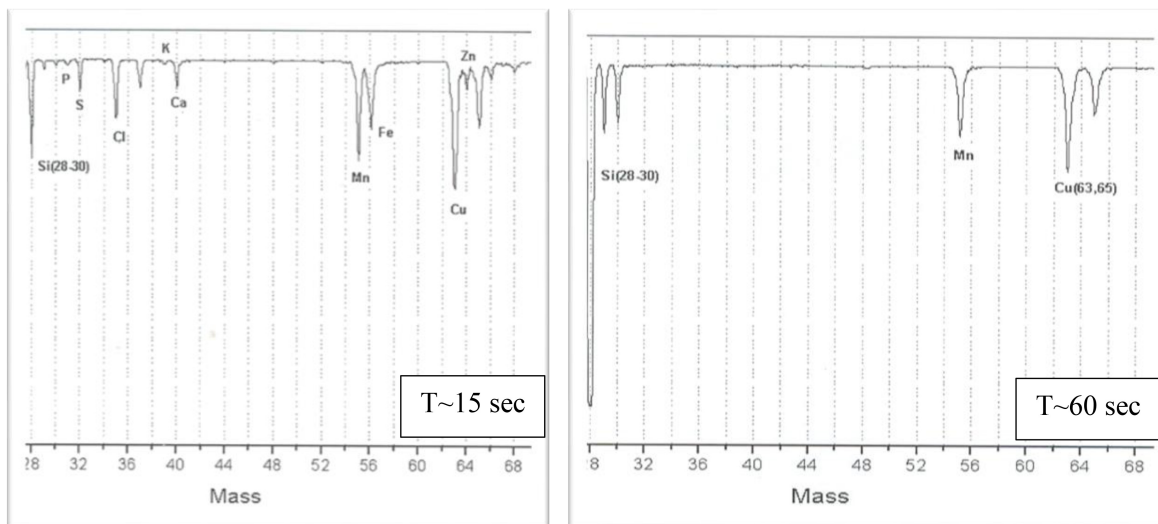


Figure 7. ISP MS method. Relative intensities of the transmuted element lines (rel. units). Al - electrode exposed in the PVR with water steam. After WINP's action on its surface. Left - after $T \sim 15$ sec of WINP's action, right - after $T \sim 60$ sec of WINP's action. Intensity of Al-line is very high and it is deleted from these spectra.

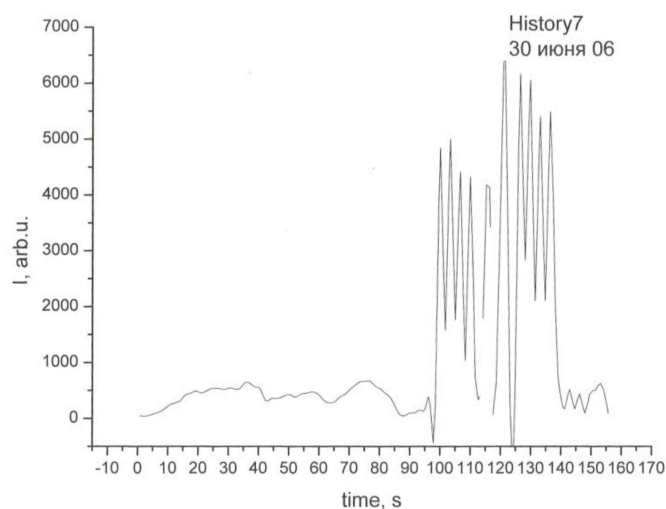


Figure 8. Optical Spectroscopy. Temporal evolution of the creation and decay of the transmuted lithium Li in the PVR. Ni-electrode (99.99%). Testing gas mixture: argon + water steam mixture. Optical Li_α -line, $\lambda = 670$ nm.

Instability of the transmuted chemical elements was recorded by the optical spectroscopy method also [5]. The creation and decay of transmuted lithium is shown in Fig. 8. One can see that bright Li_α -line ($\lambda = 670$ nm) appeared at the time $T > 95$ sec and it disappeared at $T > 140$ sec (where T – plasma operation time of the PVR).

Simultaneously the bright optical lines (duplet) of the potassium K appears in the optical spectrum at the time interval $600 \text{ sec} > \delta T > 140 \text{ sec}$. Then K-lines disappeared and bright Na-lines (duplet) appeared at the time period $\delta T > 600 \text{ sec}$. Thus, the new transmuted chemical elements are not stable.

The author supposes that the theoretical model of bi-nuclear atom [4] can explain the obtained experimental results.

4. Conclusions

1. The decay instability of the transmuted chemical elements obtained in the PVR setup was revealed in this work.
2. There is a considerable decay-instability of the new transmuted chemical elements at the time (without plasma action). The chemical analyses were performed 1 week, 1 month, and 6 months after the experiment run.
3. This instability is accelerated dramatically by a factor $10^3 - 10^6$ by weakly ionized non-equilibrium plasma (WINP) action. Ionization level of this plasma was very small $N_e/N_a \sim 10^{-8} - 10^{-7}$. But the electron temperature T_e of this plasma was very high, about of $T_e \sim 1 - 3 \text{ eV}$.
4. This type of transmuted element instability is very similar to the one revealed in the soil samples after Dalnegorskii's plasmoid explosion [3].
5. Two-step transmutation method of the new chemical element creation in LENR experiment is proposed in this work at the first time.

References

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