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Cold Fusion Experiments Using Sparking Discharges In Water

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Abstract

Experiments on the DC discharge associated with microsparks were performed in ordinary water. Thin metal wires of Pd, Ni, Ti, Fe, Cd, Mo, Pt and W were used as the electrodes. Numerous sparks appeared on the surface of the electrodes, in high voltage over 40 V, and simultaneously extraordinary phenomena were observed, such as ball-lightning like phenomena.

1. Introduction

The author has been proposing the Nattoh Model, in which cold fusion reactions can be easily induced by an electrical discharge, especially with high voltage or current density (1) and showed that many extraordinary phenomena appeared in the experiments of the pulsed electrical discharge in water (2). This paper describes experiments on DC discharges with thin metal wire electrodes in ordinary water, in which microsparks caused extraordinary phenomena such as ball-lightning.

2. Experiment

Cold fusion experiments on the discharges were performed using thin wire electrodes. Pure metals of Pd, Ni, Ti, Fe, Cd, Mo, Pt and W (0.5 - 2.0 mmϕ) were used. The electrodes were vertically immersed in ordinary water mixed with about 1.5 Mol/l potassium carbonate in a 50 ml beaker. The effective lengths of the objective and reference electrodes were about 3 mm and 15 mm, respectively. With the shorter electrode, the pinch effect of the current worked effectively to compress hydrogen or oxygen gas (1). The DC was continously employed between the electrodes, in which the voltage was varied up to about 150 V under the constant voltage mode.

3. Results and Discussion

a. Nonlinear I/V curve

Figure 1 shows the I/V curve with the Ni wire cathode and the Pt reference anode. Those features were common with the other materials except Ti. The figure shows strong nonlinearity, divided into three regions. Linearity was still maintained in the lower voltage region, but the current strongly fluctuated between about 40 and 60 V, in which the hydrogen gas seemed to explosively evolve from the surface of the cathode. Tiny sparks began to appear on the bottom tip of the cathode, and, as the voltage increased, the number of tiny sparks increased to eventually cover the whole cathode. In this case, the current was significantly suppressed to a stable level of about 0.1 A. With Ti, however, the sparks appeared on the anode and the current increased with the sparks.

When the polarity was reversed, a similar I/V curve was obtained, but the sparks began to appear over 80 V.

b. VTR Observation of Microsparks

The tiny sparks were observed in situ with a VTR system. Figure 2 shows that the tiny spark consisted of a large number of microsparks, repeatedly created or broken on the surface of the Ni cathode. The microsparks could sometimes form ring clusters with a diameter of about 20 μm, and could decay into a black cloud. Furthermore, there were strong bright spots among the microsparks. A corona-like discharge was observed from the bright spot (Sec. 3.e). On the cathode, on the other hand, the pinch effect worked strongly to induce the cold fusionreactions and to make a bank of clouds evolve with luminescence, as shown in Fig. 3.It appeared to be like the sparks.

c. Emission of Radiations

Radiations were monitored by a CsI(Tl) scintillation spectroscopy, which was placed over the water surface. When the sparks appeared, the counting rate was significantly higher than the background. The energy spectra of the radiations were continuous and declined monotonously as the energy increased. The high energy tail expanded more widely as the voltage increased. The intensity of the radiations dropped sharply as the distance between the detector and the electrodes increased. The radiations were neither gamma rays nor X-rays. The signals were generated by electromagnetic waves picked up with the circuit.

d. Nuclear Transmutation

Several elements were found by EPMA among deposited materials on the Pd wire anode: Ni, Ca, Ti, Na, Al, Cl, Cd and I. They were not observed in a reference region of the Pd wire. Furthermore, a significant amount of Ni was detected by the X-ray spectroscopy. These elements could not be asigned to impurities, but rather suggested a nuclear transmutation during the electrical discharges associated with the microsparks. For example, Cl, Ca and Ni could be transmuted by the capture of electrons, a proton and hydroxide with a K nucleus, respectively. On the other hand, Cd and I could be transmuted by the capture of a proton and oxygen with a Pd nucleus, respectively. Such captures could occur in the highly compressed state of the hydrogen cluster (Sec. 3.e).

e. Decay of Microsparks

Many ring clusters were successfully caught on the surface of the Fe cathode, as shown in Fig. 4. They decayed to a regularly hexagonal plate within a few days, as shown in Fig. 5. The intermediate stage of the decay was also observed, in which an outer zone was expanded but an inner circular zone still remained.

The ring and the hexagonal products were examined with EPMA, which obtained a two dimensional distribution of elements around the products. Besides Fe of the host metal and K of the electrolyte, some elements of Ca, Na, Cl and Cd were observed both in the ring and the hexagonal products. In particular, two circular zones that were seen for Cd were clearly separated from each other in the ring products, as shown in Fig. 6. Those observation suggested that the ring product could consist of the hydrogen cluster, and that the process of the nuclear transmutation took place in the clusters or during the formation of the clusters.

f. Nuclear Emulsions

The nuclear emulsions were placed to monitor particles that were emitted during the electrical discharge. Extraordinary rail-like traces were observed on the surface of the first nuclear emulsion. The traces suggested one-touch printing that was caused by some particles walking around on the surface. The extraordinary traces were generated by the ring products that escaped from the cell.The diameter of the ring was about 10 μm, approximately the same as that of the ring clusters observed on the Fe electrode (Sec. 3.c). This observation suggested an extraordinary result, that the ring product could penetrate the glass wall of the cell and the water region. Those curious behaviors of the ring product were previously reported (3) and were very similar to the ball-lightning phenomena in the natureal environment (4). The mechanisms of the extraordinary penetration could be caused by the itonic state of the cluster, but the details are not clear now.

Other types of exptraordinary traces were observed on the nuclear emulsions, such as a bacteria like trace, as shown in Fig. 7. It was very similar to that observed in the previous experiment of the pulsed discharge in water (3).

g. Miscellaneous

Other extraordinary phenomena were observed during or after the discharge experiments. The first was the formation of string products, which was observed with SEM on the surface of the Pd cathode after the discharges. The analysis with EDX indicated that there were only K elements in the string products. Similar string products were observed by the VTR system during the discharges. The second was the formation of film products, which were observed with the VTR system. The film product was formed at the bottom portion of the cathode, where the microsparks were frequently generated. The third was the magnetization of the Pt wires (0.5 mmφ), which were used as leading wires. The magnetization effect was noticed at the tip of the Pt wires in which the electrodes were connected. The magnetization could be related to the formation of the ring cluster, in which the closed current flows to induce the magnetic field.

References

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(3) G. Elgey, "The Mysterious Ball-Lightning", Japanese Edition by Maruzen Co., Ltd., (1990).

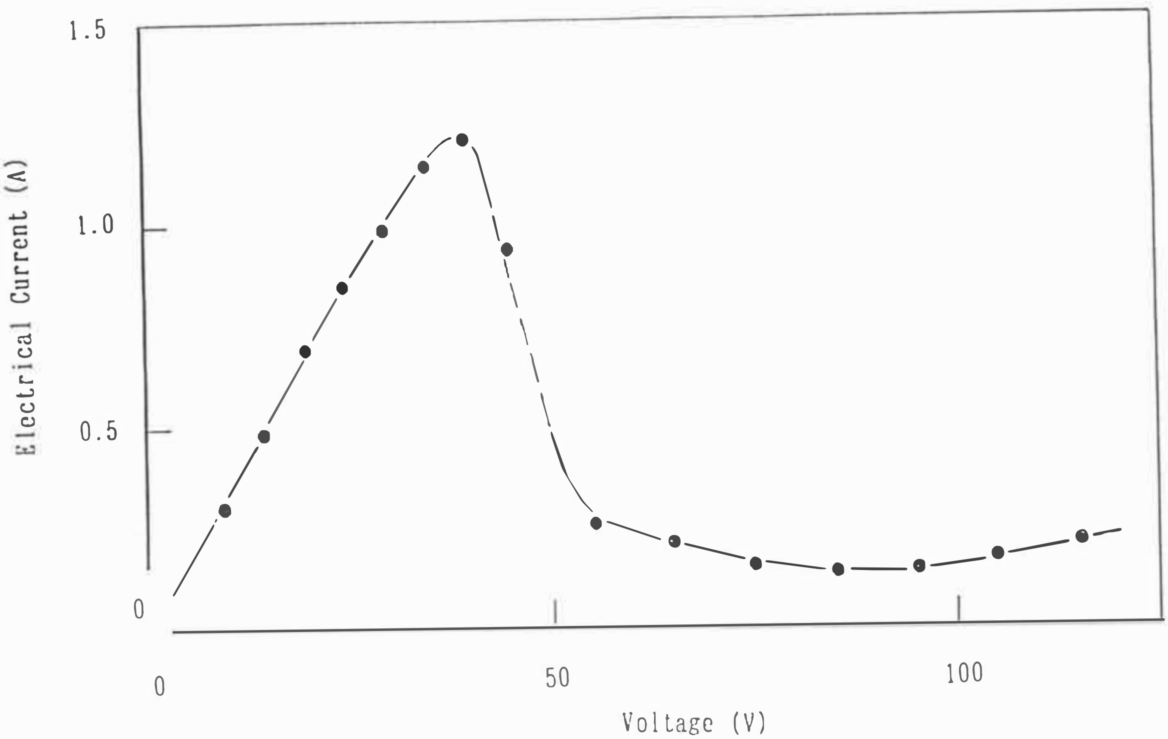


Fig. 1: Nonlinear I/V Curve

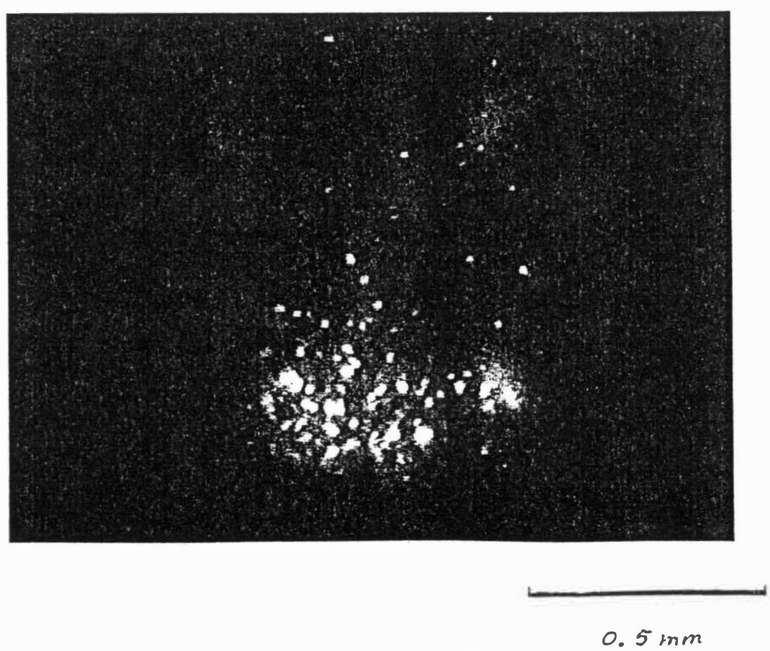
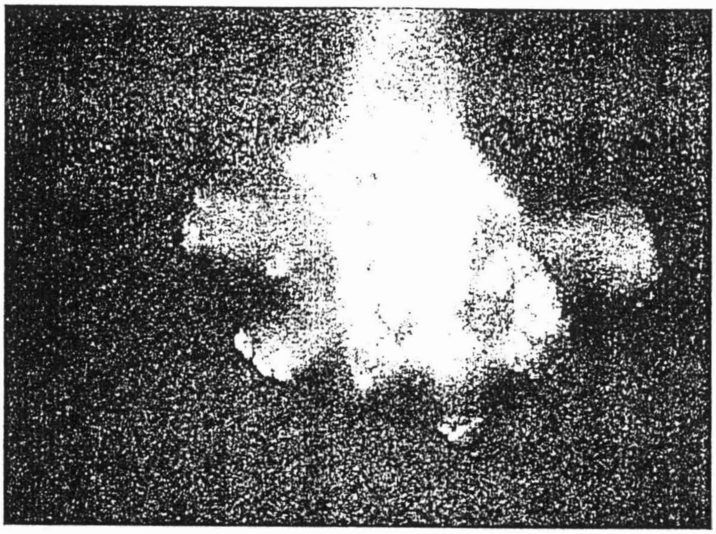


Fig. 2: Microsparks on the Ni Cathode



0.5 mm

Fig. 3: Cluster Evolution on the Ni Anode

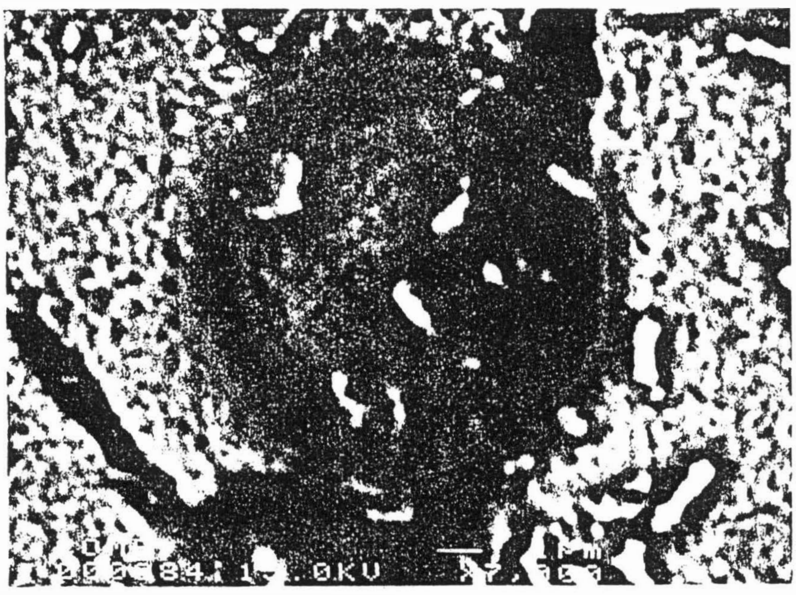
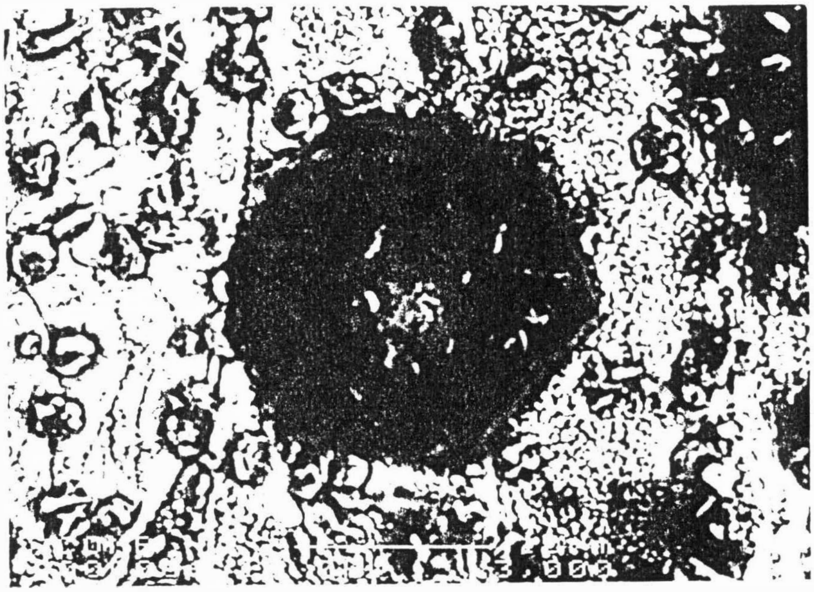


Fig. 4: Ring Cluster on Fe Electrode

1 μm



10 μm

Fig. 5: Decay Product of the Ring Cluster

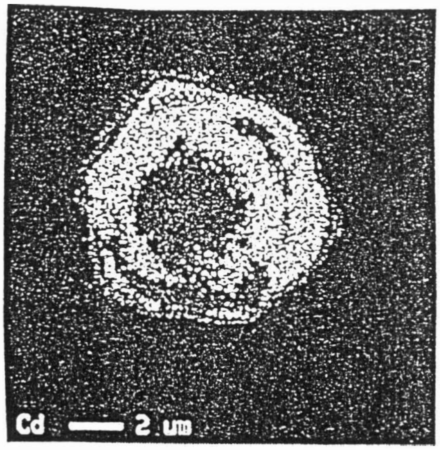
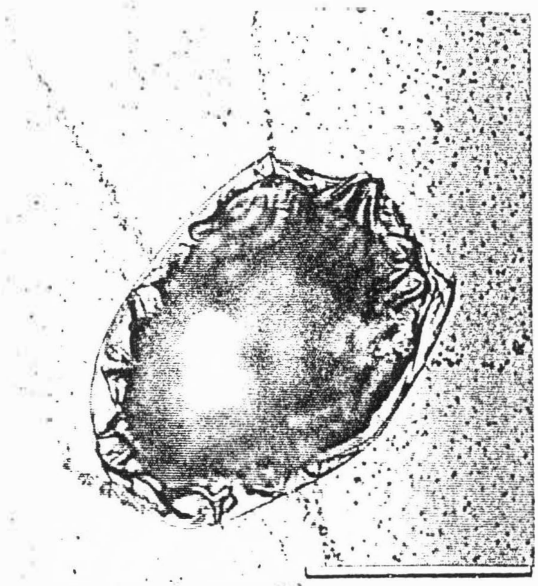


Fig. 6: Cd Distribution in the Ring Cluster



50 μm

Fig. 7: Extraordianry Trace Suggesting a Prototype of Microbacteria