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Investigation of strange radiation tracks near incandescent lamps and an electrolytic cell

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Abstract: **The studies results of two sources strange radiation are described: a reactor based on incandescent lamps and electrolytic cell. New types of strange radiation tracks are presented: drip tracks and diffuse spots. Possible reasons for the variability of track intensity are analyzed.**

Keywords: **strange radiation, tracks, drip tracks, incandescent lamps, electrolysis**

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Contents

1. INTRODUCTION

Strange radiation tracks are thought to be a contributory factor to LENR processes [1,2]. In [3,4,9], a new approach to the construction of LENR reactors was proposed, in which the process of heating the metal and the process of nuclear transformations are separated from each other. In particular, it has been shown that near ordinary incandescent lamps, nuclear transformations occur with excessive heat release.

We decided to check whether the operation of such reactors is accompanied by the release of strange radiation. This paper describes the results of experiments in 2021 with one of the reactors based on incandescent lamps. The technique used to determine the intensity of strange radiation is described in [5], DVD-R disks with preliminary control before exposure are used as a sensitive material.

In addition, in the course of verification the results presented in [6] (increased gamma background during electrolysis), experiments were performed for electrolysis cells with the accumulation of tracks using the same method.

Alongside to testing for the presence of tracks, this work also made attempts to advance our understanding of the nature of strange radiation. In many ways, this happened unintentionally, because during the experiments, unexpected manifestations of strange radiation were discovered – drip tracks and diffuse spots. Part of the experiments was done to refine the preliminary results on the screening of strange radiation [7]. Finally, an attempt to create a replica of the used reactor slightly revealed the reason for the variability in the intensity of strange radiation.

2. ARRANGEMENT OF REACTORS

Two types of reactors were used. The reactor based on incandescent lamps "IW" (Incandescent Water-cooled) worked in the "K.I.T." laboratory (Moscow). An electrolytic cell with nickel electrodes in a sulfuric acid solution was operated at MIET (Zelenograd).

The design of the IW reactor is as follows: a standard halogen incandescent lamp with a nominal power of 300 W is placed in a quartz tube through which water is pumped (**Fig. 1**). An increased voltage (320 V) is applied to the lamp to raise the temperature of the tungsten filament to ~2500°C. To equalize water pressure with atmospheric, a metal tube comes out of the top plug, i.e. the device is

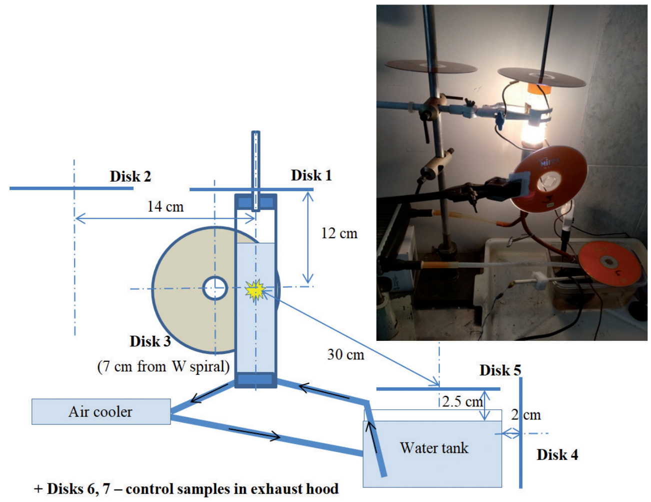


Fig. 1. *The scheme of the IW reactor and an example of the location of DVD disks during exposure.*

not sealed. Water is pumped cyclically through a water tank and a cooling air radiator using a submersible pump. The lamp contacts are sealed with layers of silicone sealant. Outside, the quartz tube is partially wrapped in Al foil to protection from the light and thermal components of the lamp radiation.

The disks were located at different distances from the reactor, single or in stacks; in a number of experiments, the disks were additionally covered with paper screens.

The disks were also placed next to a working electrolytic cell (30% H_2SO_4 solution with Ni electrodes) – **Fig. 2**. The current in the cells was on the order of 1 A. In parallel with the accumulation of strange radiation tracks, gamma radiation was measured using Geiger counters near the electrolytic cell. On Fig. 2*c* a Geiger counter in a lead container with a hole at the bottom covers the top of the electrolysis cell. The results on gamma radiation will be published elsewhere. Hydrogen, as a product of electrolysis, could freely leave the cell into the exhaust hood.

3. METHOD AND RESULTS FOR THE IW REACTOR

3.1. General statistics for the IW reactor

At the IW reactor, 9 main exposures were made with a total of 46 disks, then three more additional exposures with a total of 16 disks (additional exposures are described in Section 5).

a b c

Fig. 2. *Photo of experiments on the accumulation of tracks of strange radiation from electrolysis: (a) - electrolysis cell H_2SO_4 with Ni electrodes, (b) and (c) - the exposition of the disks during the experiments. Above and below the cell are Pb containers with dosimeters inside.*

The averaging of the total track length over the main exposures is shown in **Fig. 3**. These results confirm previously obtained data on other types of reactors: Ni-H reactor, and plasma electrolysis in water [5]: on average, about 1000 mm of tracks per disk in the near zone of the reactors (up to 20 cm) and two orders of magnitude less - in the far zone (more than 20 cm from reactor).

Fig. 4 shows the distribution of the total length of the tracks from the distance. It can be considered as a *noticeable* number of tracks on one disk more than 100 mm, and a *large* number of tracks – more than 1000 mm per disk. Then it can be seen that no noticeable number of tracks is observed beyond 20 cm, and the disks with a large number of tracks were all located at a distance of up to 12 cm from the reactor.

The tracks that appear as a result of exposures are similar to those observed in other types of

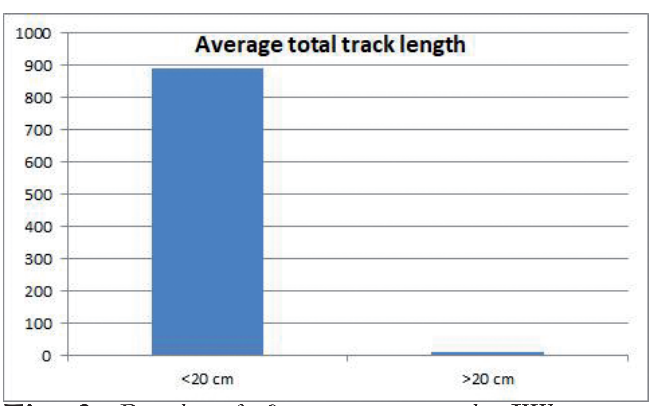


Fig. 3. *Results of 9 exposures at the IW reactor. Average values are shown for total track lengths on 46 disks (mm).*

LENR reactors [5], their detailed consideration is given in [8].

Further, the results of some exposures are considered in more detail.

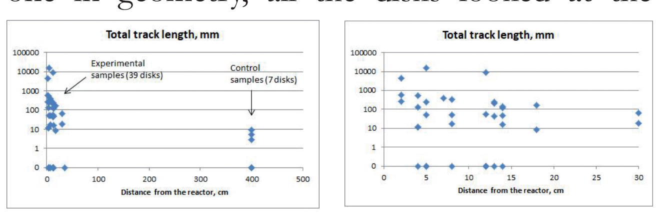
3.2. Example of a typical exposure (19.07 – 26.07.22)

5 experimental disks were placed at different distances <1 m from the IW reactor (**Fig. 5**). Two control disks were placed at a distance of 4 m in an exhaust hood in the same laboratory. Disks 1–3 were directed with their sensitive side to the reactor, disks 4 and 5 were directed to the water tank. The total time of active operation of the reactor (i.e., the lamp is on, water is circulating) was 34 hours. The disks were placed at the reactor for a calendar week.

The results in Fig. 5 show the largest number of tracks for the disk closest to the incandescent lamp (7 cm). The rest of the disks showed a small number of tracks.

3.3. Drip tracks from electrolysis (exposition 27.07 – 17.08)

This exposition almost repeated the previous one in geometry, all the disks looked at the



a b

Fig. 4. *Distribution of the total track length as a function of the distance to the reactor (logarithmic scale in the y axis): (a) - all exposures, (b) - only up to 30 cm.*

reactor with their sensitive side, but one of the disks was located next to the air radiator and was turned towards it. The layout of the disks and the results are shown in **Fig. 6**. Disks have been in the same place for three calendar weeks.

Here, the dependence on distance was also generally confirmed, as well as a large variability in the intensity of the tracks: in the "effective" disks B and C located in the near zone, there were an order of magnitude more tracks than in the previous exposure, with a shorter reactor operation time (11h).

Changes were unintentionally introduced into the course of this experiment: in addition to the regular operation for ~10h, due to damage to the tightness of the insulation of the lamp contacts, the reactor operated for about an hour in the electrolysis mode. This led to the formation of atypical "drip" tracks on disk B located above the leaky plug (**Fig. 7**). These tracks are formed by dried traces of water droplets, apparently coming out in the form of an aerosol in the electrolysis mode together with hydrogen. But what distinguishes them from ordinary drops is their linear arrangement (sometimes passing through the entire disk), most often in the form of parallel lines (**Fig. 8**).

Almost all the tracks on this disk have this "drip" look. The size of the drops and the step between the drops composing these tracks vary widely.

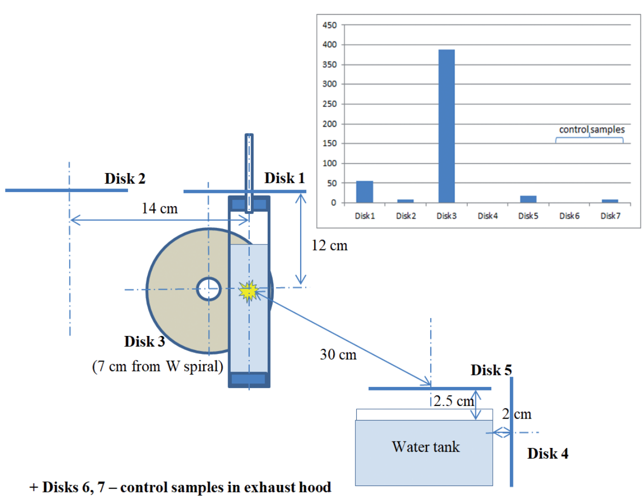


Fig. 5. *Total length of tracks (mm) for disks in experiment 19.07.*

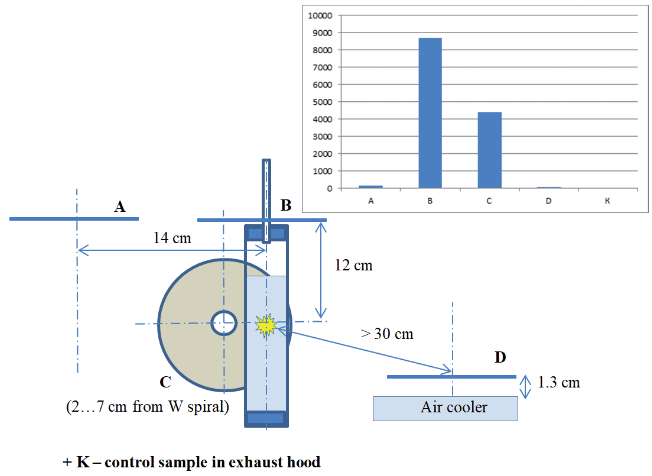


Fig. 6. *Experiment 27.07 and its results. The total length of the tracks is shown, mm.*

Among the drip tracks, there are sometimes ordinary tracks running parallel to the drip tracks (Fig. 8c).

3.4. Exposure after lamp replacement (13.08-17.08)

A short exposure was made after changing the lamp in the reactor. The time of active operation of the reactor was only 1 hour, the rest of the time the reactor was turned off. Nevertheless, a significant number of tracks are appeared on a single exposed disk (575 mm). The distance from the disk to the center of the reactor was 2 cm, the disk was located vertically.

3.5. Exposure with paper screening (17.08-31.08)

During this exposition, it was decided to test the storage/shielding properties of the paper. To do this, one disk was placed vertically without paper at a distance of 2 cm, and another 4 disks were stacked with paper disks (office paper for printers, completely covering the surface of the disks) at a distance of 13 cm from the center of the reactor (**Fig. 9**). The operating time of the reactor was 1.5 hours.

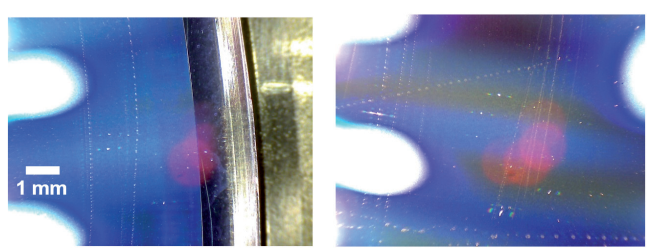
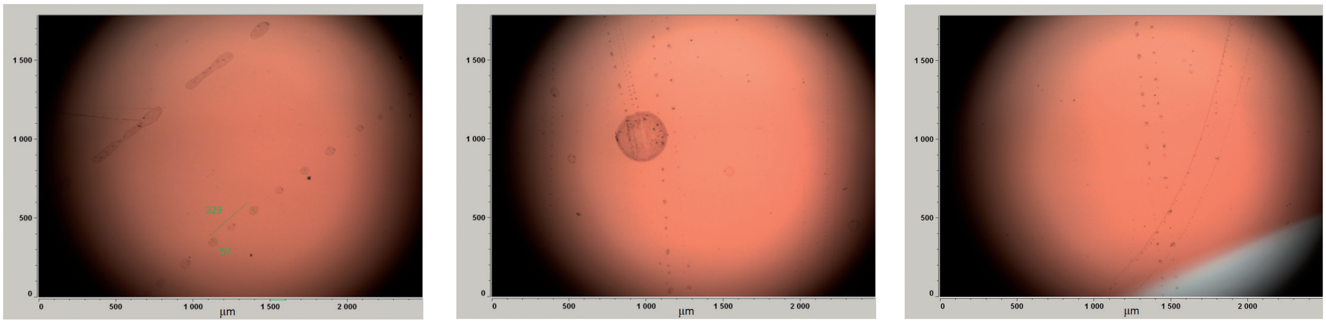


Fig. 7. *Examples of "drop" tracks near the IW reactor after the electrolysis mode (optical microscope).*



a *b* *c*

Fig. 8. *Arrangement of drops in drip tracks (optical microscope).*

In the stack of disks B-C-D-E, there are a noticeable number of tracks only on the outer disks B and E, their surface was covered with paper, disk E looked from the reactor. This suggests that strange radiation is passing through the paper. This result confirms the earlier results of 2018, when several disks were placed in a stack in a common paper envelope to protect against dust (**Fig. 10**) and exhibited at the water plasma electrolysis reactor. Then the outer disks also showed a large number of tracks, including a disk turned away from the reactor and covered with paper.

3.6. Exposure with diffuse tracks (31.08-10.09)

During this exposure, an attempt was made to study the dependence of track intensity on distance in the near zone. For this, 4 disks were placed horizontally almost close to the IW reactor with a separation of 2 cm between the disks, one more disk was a control (in the hood) - **Fig. 11**.

For disk A, the only one with a significant number of tracks, the distribution of the total track lengths was calculated depending on the distance to the reactor surface in segments of 10–15 mm, 15–20 mm, etc. (**Fig. 12**).

This single-disk result is by itself not representative enough, although it does not contradict previous data. It shows that the tracks on this disk are formed in the zone of 10...45 mm from the surface of the reactor, with a peak in 25-30 mm.

In addition, this exposure revealed a certain feature of the surface areas of the exposed disks at a distance of about 1 cm from the reactor surface. Formations that can be characterized as diffuse spots are found on disks B, C and D (**Fig. 13**). Moreover, these disks contain almost no ordinary linear tracks.

Similar spots have already been seen in the 2018 exposures at various reactors (18 disks) and in 1 control disk. An example of an outstanding diffuse spot during exposure to a hot Ni-H reactor is shown in **Fig. 14**. Such disks also did not show a noticeable number of regular tracks.

If we return to Fig. 13, and taking into account the relative position of the disks in the exposure, we can assume the 3D nature of the phenomenon – as if something "exploded" near the edge of the disks. From this "explosion" ordinary linear thin tracks appeared on the disk

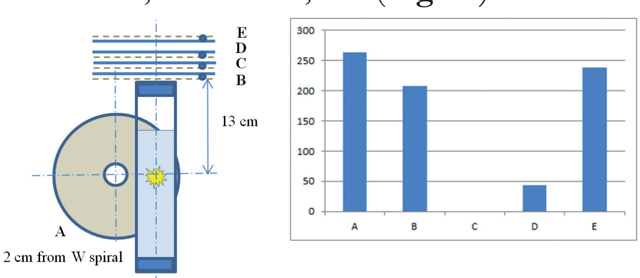


Fig. 9. *Scheme of exposure 17.08-31.08 at the IW reactor and its results (total track length, mm). The sensitive side is marked with dots.*

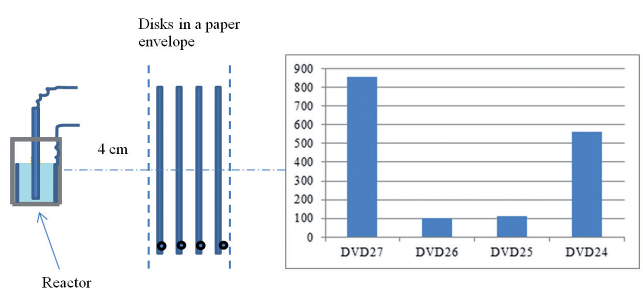


Fig. 10. *Scheme of the experiment in 2018 and its results (the disks were placed in a paper envelope in the order 27-26-25-24 in a row from the reactor).*

A (grouped, as usual, in groups of the order of 1 cm^2). On the disks B, C, D sleeves appeared in the form of diffuse spots. Thus, the diameter of the spatial region of traces of such an "explosion" is about 6 cm.

3.7. Exposition 10.09-23.09

As a continuation of the experiments with paper pads, the following exposure was made. The top stack of DVD-R disks with paper disks was placed in the same geometry, and a stack of disks was added, standing close to each other without paper (**Fig. 15**). The operating time of the reactor is 38 hours.

The results are presented in Fig. 15. Although the absolute number of tracks in a stack of disks with paper is small, their relative value confirms the results obtained earlier: paper does not prevent the appearance of strange emission tracks. At the same time, closely spaced disks shield each other, which confirms earlier experiments with shielding [7]. Two control disks showed no tracks.

3.8. Short exposure after lamp change 23.09

On September 23, the halogen lamp in the HB reactor burned out, a new one was supplied, and after 20 minutes it also burned out. But during

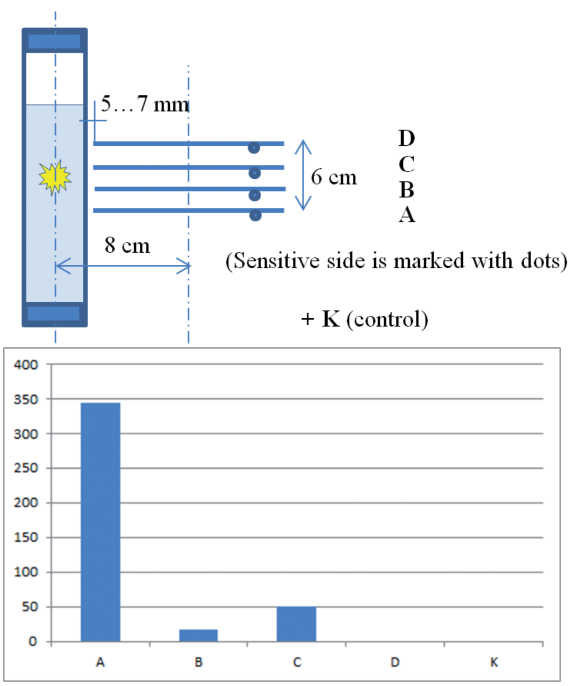


Fig. 11. *Scheme of the exposure on 31.08-10.09 at the IW reactor and its results (total track length, mm).*

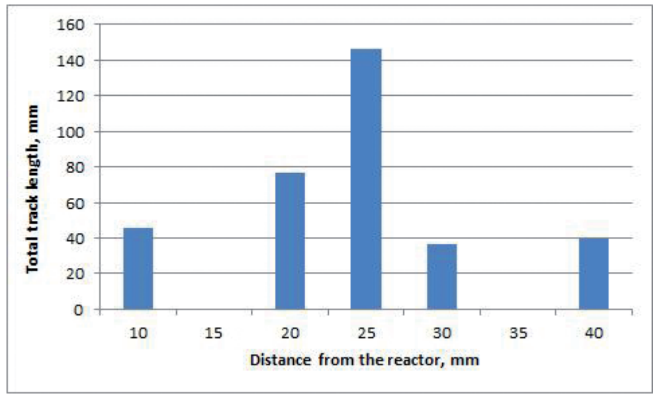


Fig. 12. *Distribution of total track lengths (mm) according to photographs of areas of disk A, depending on the distance to the reactor surface.*

the operation of the new lamp, 2 new disks were placed - one on top at a distance of 14 cm, the second on the side, at a distance of 4 cm, similar to the previous exposure. They featured 143 mm and 127 mm tracks respectively. It is noteworthy that this number of tracks was obtained in just 20 minutes of reactor operation.

3.9. Exposition 24.09 – 16.10

Another exposure with and without paper disks was carried out according to a scheme similar to the previous one, but the disks without paper were placed in a stack above

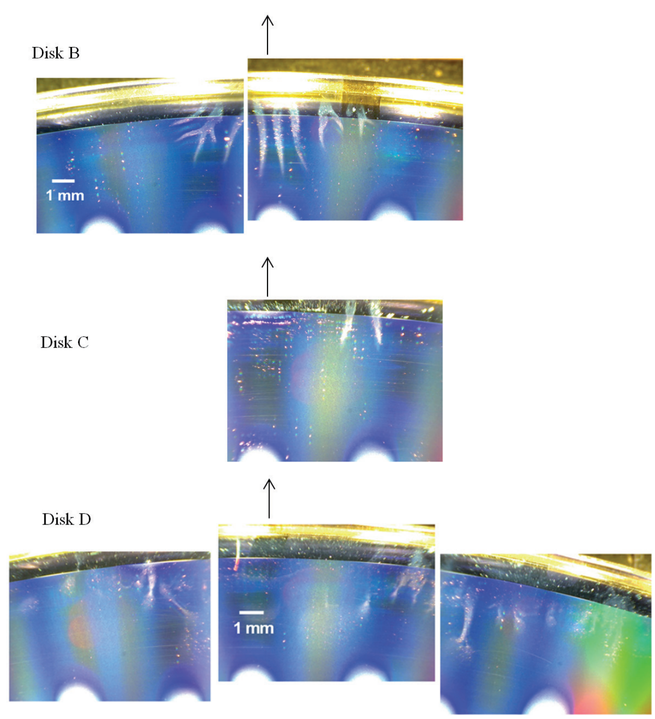


Fig. 13. *Diffuse spots on disks B, C, D, edge adjacent to the reactor surface. The arrow shows the direction to the reactor.*

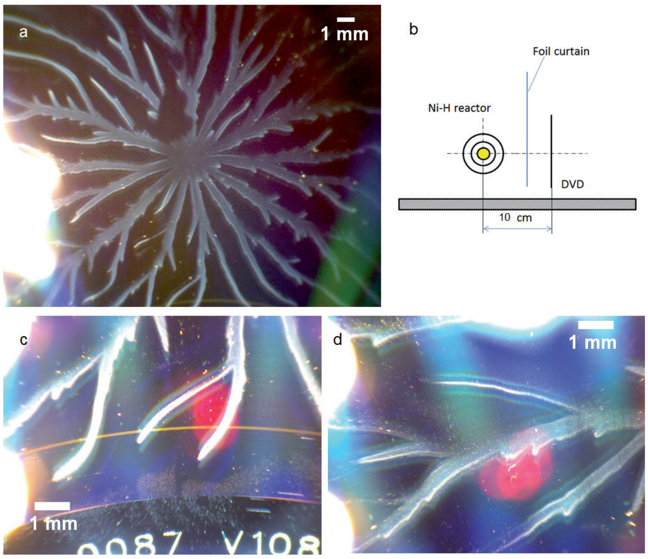


Fig. 14. *Diffuse spot on the surface of a DVD28 disk (2018), exposure at the Ni-H reactor: (a) - general view, (b) - exposure scheme, (c, d) - details.*

the reactor, and the disks with paper were stacked on the side (**Fig. 16**). A sample of polished silicon (Si) was also placed. The total operating time of the reactor was 83 hours. A noticeable number of tracks showed only disk D, located closer to the reactor and covered only with paper. No tracks were found on silicon.

4. METHOD AND RESULTS ON THE ELECTROLYSIS OF Ni + H_2SO_4

3 exposures were carried out with the same arrangement of disks near the electrolysis cell. The disks were located at a distance of 10 cm from the cell (A, B, C, D), there were also several control (K) disks located at a distance of 2 m. In the first exposure, the electrolysis time was 4 hours, in the second - an hour and a half, in the third – 10 hours. The results are presented in **Fig. 17**. It can be seen that only the first two exposures were effective in terms of the number of tracks (there were disks exceeding 100 mm). The average total track length in the experiment was 234 mm (12 disks), in the control 10 mm (5 disks).

During the processing of the disks, the drip character of the electrolysis tracks was revealed (**Fig. 18**). Tracks similar in character were observed in the IW reactor also in the

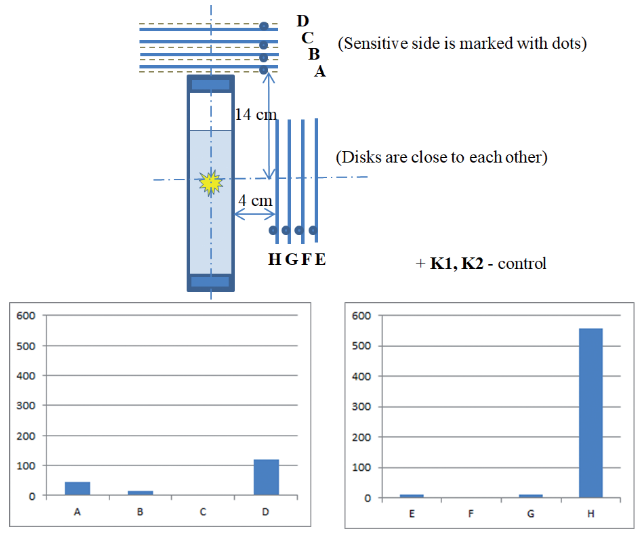


Fig. 15. *Arrangement of disks in the exposure 10.09-23.09 near the reactor and the result of the exposure.*

electrolysis mode. We see that the presence of a humid environment (aerosol leaving the electrolysis zone together with gas) contributes to the appearance of drip tracks.

5. ATTEMPTS TO CREATE A REPLICA OF THE IW REACTOR

The IW reactor worked in the "K.I.T." laboratory in Moscow and showed the typical number of tracks of strange radiation for LENR reactors, with the great variability of the intensity of the tracks inherent in this phenomenon. In parallel with the exposures at this reactor, in the laboratory at MIET, Zelenograd, a similar reactor based on incandescent lamps was being created. During several iterations, a reactor was created (**Fig. 19**), repeating all the main parameters of the IW reactor: lamp type, lamp supply voltage, filament temperature, water circulation, tube material (quartz).

Various modes of reactor operation were tested, during which disks were exposed at a distance of 2–10 cm. In none of the exposures at MIET, a noticeable (>100 mm) number of tracks was obtained with an active operation time similar to the operation of the IW reactor in the "K.I.T." laboratory in Moscow. In parallel with the work of the replica with zero results in Zelenograd, there were effective exposures in Moscow at the original IW reactor. In addition,

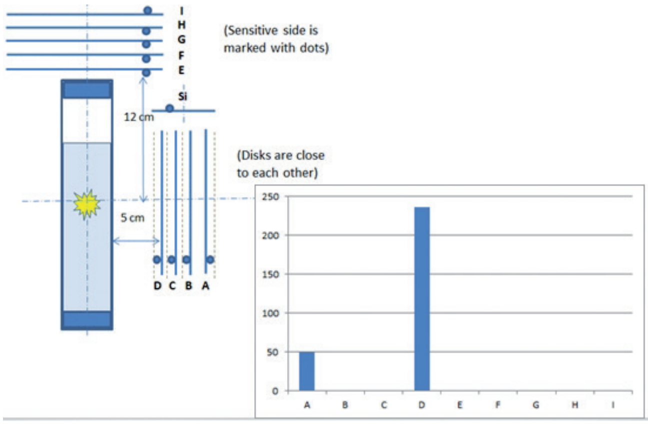


Fig. 16. *Exposition 24.09 and its results.*

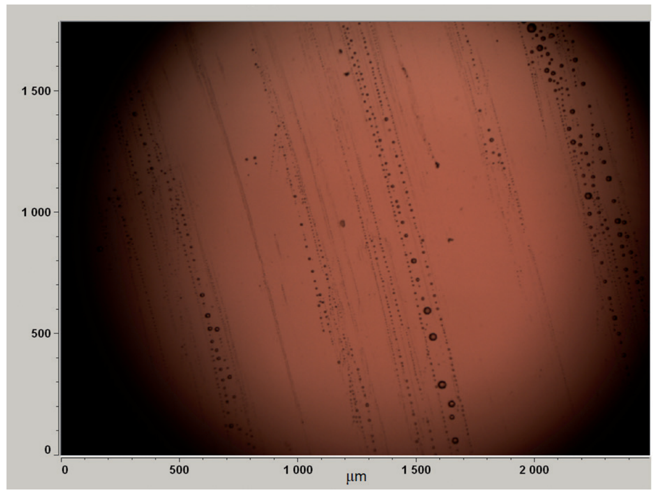


Fig. 18. *Examples of drip tracks on disks near an H_2SO_4 electrolytic cell with Ni electrodes.*

drip tracks were obtained from electrolysis cells in the same MIET laboratory. Therefore, the influence of the location of the installation, as well as any "seasonal" factors can be excluded.

During the analysis of the situation, a hypothesis was put forward that the alleged source of strange radiation – incandescent lamps – differ in MIET from those used in the "K.I.T." laboratory. They were of the same power and the same design, but from a different manufacturer. To check the non-equivalence of the lamps, three additional exposures were made on the original IW reactor. For these exposures, we used lamps from the same manufacturer and purchased at the same time as those used in the experiments at MIET and did not show a noticeable number of tracks there. On each of these three exposures we used a new lamp.

To compare the effectiveness of lamp exposures in the IW reactor, **Fig. 20** shows the total length of the tracks across the disks, as well as the rate of track formation (the total length of the tracks is divided by the active operation time of the reactor). Expositions with lamps brought from Zelenograd are marked with curly brackets at the end. Expositions with new just replaced lamps from the "K.I.T." laboratory are highlighted in red, and expositions with lamps brought from MIET are highlighted in green.

It can be seen that none of the three additional exposures in the original IW reactor with MIET lamps showed a noticeable number of tracks (exceeding 100 mm per disk). In addition, these exposures show track formation rates close to zero. The average total track length for such exposures is 12 mm (over 16 disks), which corresponds to the control values (see Fig. 3), i.e. background values.

6. DISCUSSION OF RESULTS

One of the objectives of this study was to find the source of strange radiation. Despite the triviality of this issue at first glance, it was not obvious that the incandescent lamp is such a source; it

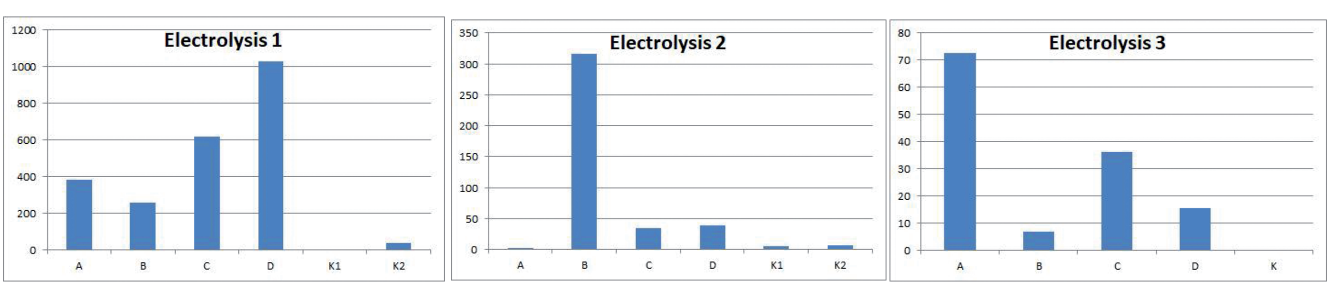


Fig. 17. *Total length of tracks (mm) from three exposures of disks during H_2SO_4 + Ni electrolysis.*

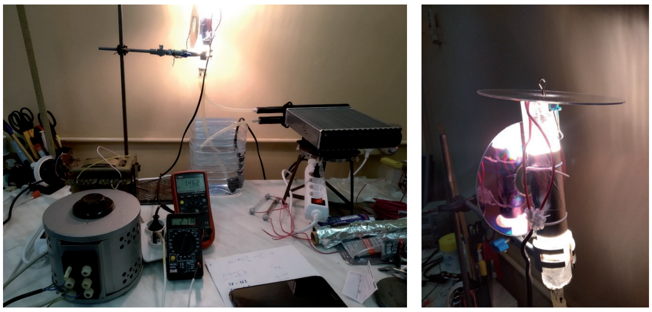


Fig. 19. *Reactor - a replica of IW at MIET (left) and an example of the exposure of disks on it (right).*

could be, for example, water as an accumulator of strange radiation. The results, nevertheless, speak in favor of the fact that not just a tube with a lamp located and circulating water inside, but it is the incandescent lamp itself that is the source of strange radiation from the reactor. This is evidenced primarily by the fact that replacing the lamp with a new one led to a significant increase in the rate of track formation immediately after such a replacement (see the red bars in Fig. 20 below).

Another argument in favor of lamps as a source: we see that not all lamps work as an effective source of strange radiation. Replacing "efficient" series lamps with "inefficient" series led to the disappearance of tracks in the original IW reactor.

This difference is statistically significant. **Fig. 21** shows the average track formation rates in three categories of exposures: from just replaced "efficient" series lamps, subsequent exposures from the same "efficient" lamps, and exposures from "inefficient" series of lamps. All these exposures were at the same IW reactor, only the lamps were changed.

Here we should return to the question of what is strange in the behavior of the tracks. In addition to the mysterious twin tracks (exact copies), periodic tracks, there is also a "shell paradox": those solid particles that leave tracks on the sensitive surface of detectors in the near zone do not violate the tightness of the reactor shell. It was shown in [8] that the tracks are formed by the motion of solid particles with a size of the order of microns – tens of microns.

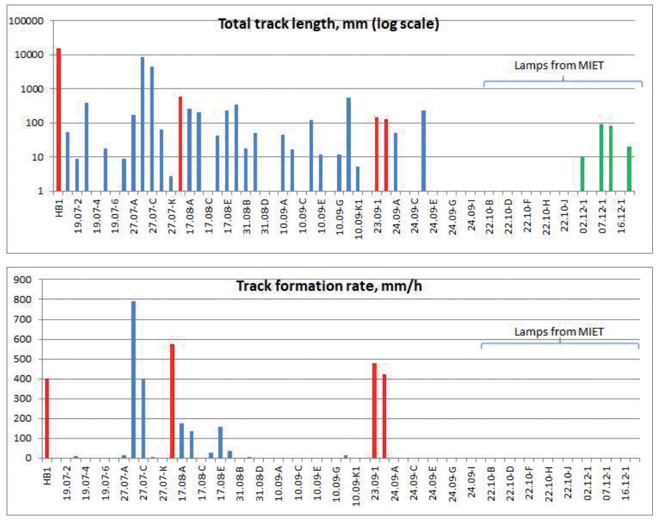


Fig. 20. *Total track length (mm) and track formation rate (mm/h) at the IW reactor for all experiments. Exposures with new just replaced incandescent lamps (lamps from KIT), green - lamps of the same type that were used in the replica (lamps from MIET).*

Obviously, particles of this size, if they flew out of the center of the reactors (in the case of incandescent lamps, for example, from a tungsten filament), would violate the tightness of the bulb. However, this does not happen. So what comes out of LENR reactors and in what form?

The results of this work allow us to slightly expand our understanding of strange emission tracks. Drip tracks confirm the hypothesis that the tracks are formed by solid particles, but under the conditions of an aerosol environment near electrolysis do these particles begin to capture electrolyte drops and smear them over the surface. Drip tracks very clearly show the fact that particles move along the surface: these particles leave their "watermarks", and the larger the particle size, the larger drops it captures during movement (Fig. 7, 8, 18).

Quite important, in our opinion, is the observation that drip tracks are much longer than ordinary tracks: during electrolysis in ordinary tap water, tracks were formed that passed almost through the entire disk, with a length of several cm, while ordinary tracks have a characteristic length of an order of magnitude less.

Why are drip tracks longer than regular tracks? It can be assumed that in this case the process of particle motion occurs with lower friction forces, since it contains liquid. Solid particles, having hydrophilic properties, move in a liquid shell, less energy is spent on such sliding. It should be recalled that strange radiation tracks can only be explained by the movement of solid particles if there are external forces that initiate such movement. We estimate the order of magnitude of such forces as 10^{-3} N [8]. These forces do work on the movement of particles against friction forces, this work converts into heating both the sliding or rolling particles themselves, and into heating and melting the surface material. It is quite possible that particles in drip tracks move at a higher speed than in ordinary tracks. In addition, they should heat up less and break down more slowly.

A question that often comes up when discussing the nature of tracks is: can they be formed by dust particles? This is a quite reasonable assumption, and in the present work some of the experiments have some bearing on it. Between the quartz tube, which apparently remains intact, and the disks, there is an air gap with convection currents with an uncontrolled amount of dust. In a number of experiments, paper screens were used to cover the surface of the disks. From this, tracks do not stop forming, in addition, for disks that are directed with the sensitive side down, tracks are still formed. This means that the dust that is already lies on the disks is not involved in motion, otherwise the disks covered with paper and turned down should show a noticeably smaller number of tracks due to low dust content, but this does not happen (see Fig. 9, 10 , 11, 15, 16). Moreover, in previous experiments, we did not observe a correlation between the number of tracks and the dustiness of the disks. It is possible that these particles, already moving under the action of forces, fly under the paper parallel to the surface, or they pierce the paper (we did not analyze the paper after the exposures).

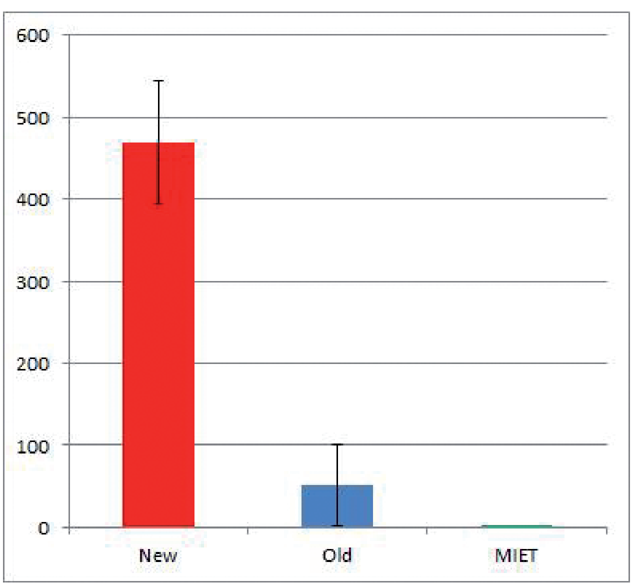


Fig. 21. *Average rate of track formation, mm/h, based on exposures from new lamps ("New"), subsequent exposures from the same lamps ("Old"), and exposures from lamps from MIET ("MIET").*

Previous preliminary results on shielding have shown that closed boxes containing disks protect them from tracks, and stacked disks also protect each other [7]. In the present work, we did not make solid screens, but at least the results with disk stacks confirm the previous screening results.

Finally, rather interesting results with diffuse spots raise more questions rather than answers. Fig. 13 shows that such spots are formed near the reactor (at a distance of about a centimeter from the quartz tube). Is this the particles forming stage? What is the substance that makes up the white coating on the disks? Why do they look similar to lightning streamers (Fig. 14)? These are all open questions for which we do not yet have answers. But it can be seen that in the exposure in Fig. 11 for disks B, C, D diffuse spots end approximately at the same distance from the edge of the disks (1 cm) where ordinary tracks begin at disk A, and after 40 mm from the reactor in this exposure there are neither diffuse spots nor ordinary tracks.

7. CONCLUSION

The following conclusions can be considered preliminary. This is due to insufficient statistics in some cases and the fact that some of the phenomena described in the article are apparently observed for the first time. Continued experimentation is needed.

1. Incandescent lamps are effective sources of strange radiation that form tracks, with the same characteristic features in terms of intensity in the near zone, and the nature of the tracks, as from other LENR reactors.
2. Electrolysis is also a source of tracks. The aerosol atmosphere during electrolysis leads to drip tracks, which can be an order of magnitude longer than conventional tracks of strange radiation.
3. Drip tracks look like parallel lines formed by microdroplets of various sizes.
4. The source of strange radiation in the IW reactor is the incandescent lamp, but not every instance of the incandescent lamp is effective as a source of strange radiation.
5. The rate of track formation is greater in the first hours of operation of new incandescent lamps.
6. Tracks are effectively formed also when the surface of the sensitive material is protected with paper.
7. Sometimes, instead of the usual tracks, diffuse spots of an unclear nature are formed.

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