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Statistics and structure strange radiation tracks from two types of LENR reactors

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Abstract —The statistics of tracks of strange radiation was studied at different distances from two types of low-energy nuclear reactions. The patterns found make it possible to assert that these reactors are indeed sources of strange radiation. Various materials have been tested that are suitable for studying tracks: photographic film, glass, mica, plastic. The features of the tracks are analyzed using the methods of optical, electron, and probe microscopy.

The problem of strange radiation from low-energy nuclear reactions (Low Energy Nuclear Reactions - LENR) has a nearly 20-year history, for example, see [1], [2], [3], [4], [5], [6]]. The term “strange radiation” was first introduced in the work of L.I. Urutskoeva and colleagues [1], now there is a growing interest of researchers to this phenomenon [7], [8], [9], [10], [11], [12].

In various experiments, some of which do not have the LENR directivity, similar traces appear on the surface of sensitive materials, mainly photographic foam. The main feature of such tracks is that they run strictly along the surface of the material, in contrast to the tracks of ionizing particles. In some papers, it has been noted that the tracks of strange radiation contain chemical elements that were not in the source materials [4], [2].

In a previous study by one of the authors, an attempt was made to replicate the method of obtaining strange radiation using a laser and magnetized water [13], [14]. Although it was not possible to confirm the results of the original method [15] (the statistics of the tracks in the experiment and control coincided), nevertheless, the author obtained the tracks characteristic to strange radiation. It was concluded that they were caused by an unknown source (background radiation). In this connection, the question arises whether the appearance of tracks is really related to the operation of devices in which LENR processes take place. To answer this question, experiments are needed in which statistical results are reliably compared with background LENR installations.

The second reason for the relevance of this work is due to the fact that there are results indicative of the biological activity of strange radiation [16], [17]. Another work suggests similar biological effects from radiation from torsion generators [18]. Obviously, studies of

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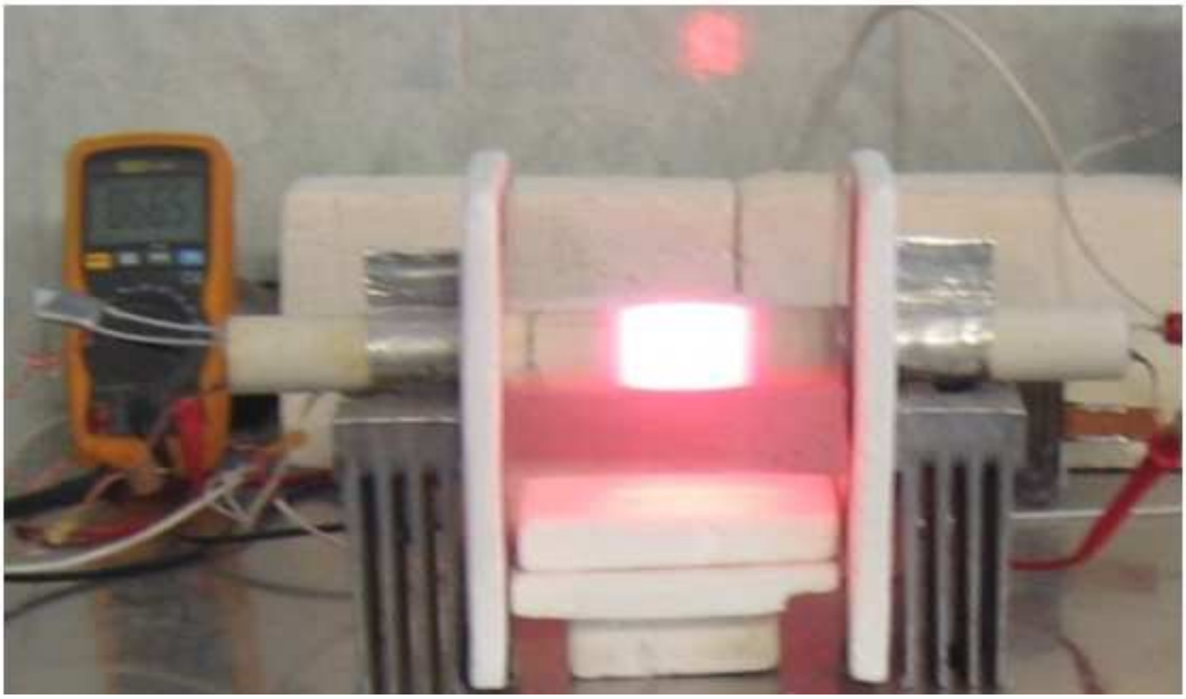
the properties of strange radiation are important for solving the safety problems of experimenters and potential users of LENR reactors.
The purpose of this study is to determine whether the operation of LENR reactors and tracks of strange radiation are related. For this purpose, a technique was developed for the numerical estimation of the intensity of the appearance of tracks, and optimal materials were chosen for accumulating tracks. In addition, the structure of the tracks arising on various materials was investigated.

II. Materials and methods

Reactors of two types were used as devices in which LENR processes take place. The first device is a Ni-H reactor operating in the continuous mode of generating excess heat (Fig. 1a). This reactor operated non-stop for 225 days with an average power of excess heat of 200 W [19]. The second reactor is a plasma electrolysis cell in water with movable electrodes (Fig. 1b). The upper electrode is periodically in contact with the bottom, which leads to the appearance of plasma in the discharge gap. Electrodes made of graphite, copper, and tungsten were used. Unlike the Ni-H reactor, which operated in a relatively stable mode, the water reactor operated in various modes with a power consumption of 100-400 W.
To identify tracks from reactors, a method of sequential and parallel control was used. Previously, prior to exposure at the reactors, samples of sensitive material were photographed with an optical microscope at a slight magnification (x55), then, after exposure, the survey of the entire sample was repeated. For subsequent comparison, photographing transparent materials was done on the coordinate grid in the background with a positioning accuracy of 3 mm. sequential control.



(a)

(b)

Fig. 1. Ni-H reactor (a) and plasma electrolysis reactor in water (b).

The point was that in the analysis only those tracks that were absent in the preliminary photos but appeared in the samples after exposure near the reactors were taken into account. Parallel control consisted in the fact that, in parallel with the exposure at the reactors, the same samples were exhibited in other places removed from the reactors. Processing of control samples was performed in the same way as the main ones.
For the accumulation of tracks various materials were tested. Initially, rolled b/w film and sheet x-ray films were used. However, photographic films turned out to be an inconvenient material for the purposes of the present study, since the task was posed to maximize the reliable estimation of the rate of appearance of tracks of strange radiation, rather than studying the types of tracks, as has been mainly done by researchers so far.
After it was found out that the tracks are formed on virtually any smooth surfaces, we abandoned the use of photographic materials requiring fairly complex processing and introducing difficult-to-control artifacts.
Convenient detectors for recording tracks that allow placement near a hot reactor are microscope slides.
In addition, muscovite mica was tested with a thickness of 15–30 µm, 50x50 mm in size.

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In addition, muscovite mica was tested with a thickness of 15–30 μm, 50x50 mm in size. During preliminary studies, the rate of accumulation of tracks on mica turned out to be higher than on glass, with equal processing convenience, however, this material was available only in a small amount.

The most convenient material turned out to be standard DVD-R discs made of polycarbonate. One side of the disc is very smooth and free from defects. The reverse side is covered with Al sputter coating and is a reflective surface. This is convenient when analyzing tracks under a microscope. At the same time, DVD-R discs have a marked track system, creating a diffraction pattern that can interfere somewhat with recording and analyzing tracks at certain angles of illumination of the surface. The main results on the set of statistics were obtained on DVD-R. Only the smooth side of the discs (polycarbonate) was analyzed.

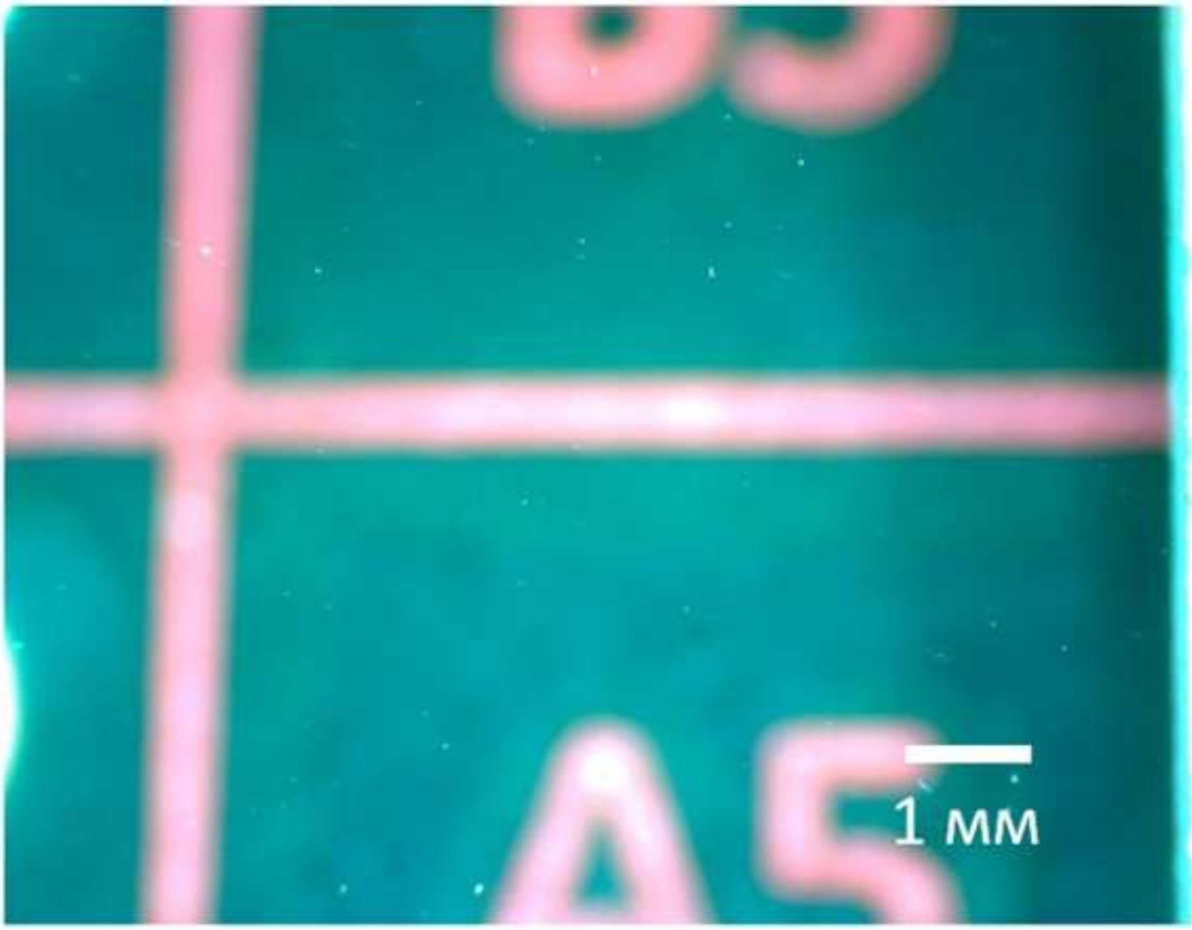
The method of numerical evaluation of the intensity of the appearance of tracks consists in calculating the total length of the tracks and comparing the obtained values of the experimental samples with the control. For this, the photos of the sampled areas of the samples were opened first with a graphics editor and the tracks of strange radiation were outlined with the pencil tool of a fixed color and a fixed thickness. Then, by a group of photographs, the total length of lines of a given color was calculated programmatically. Thus, the method of estimating the intensity contains both a manual component (trace of the tracks) and an automatic component (calculation of the total length). The calculation method does not imply the calculation of the average length of the tracks.

Note that among the effects of strange radiation, some researchers include not only long tracks — i.e. ines — but also micro-craters [20], [8]. The above technique takes into account only long tracks.

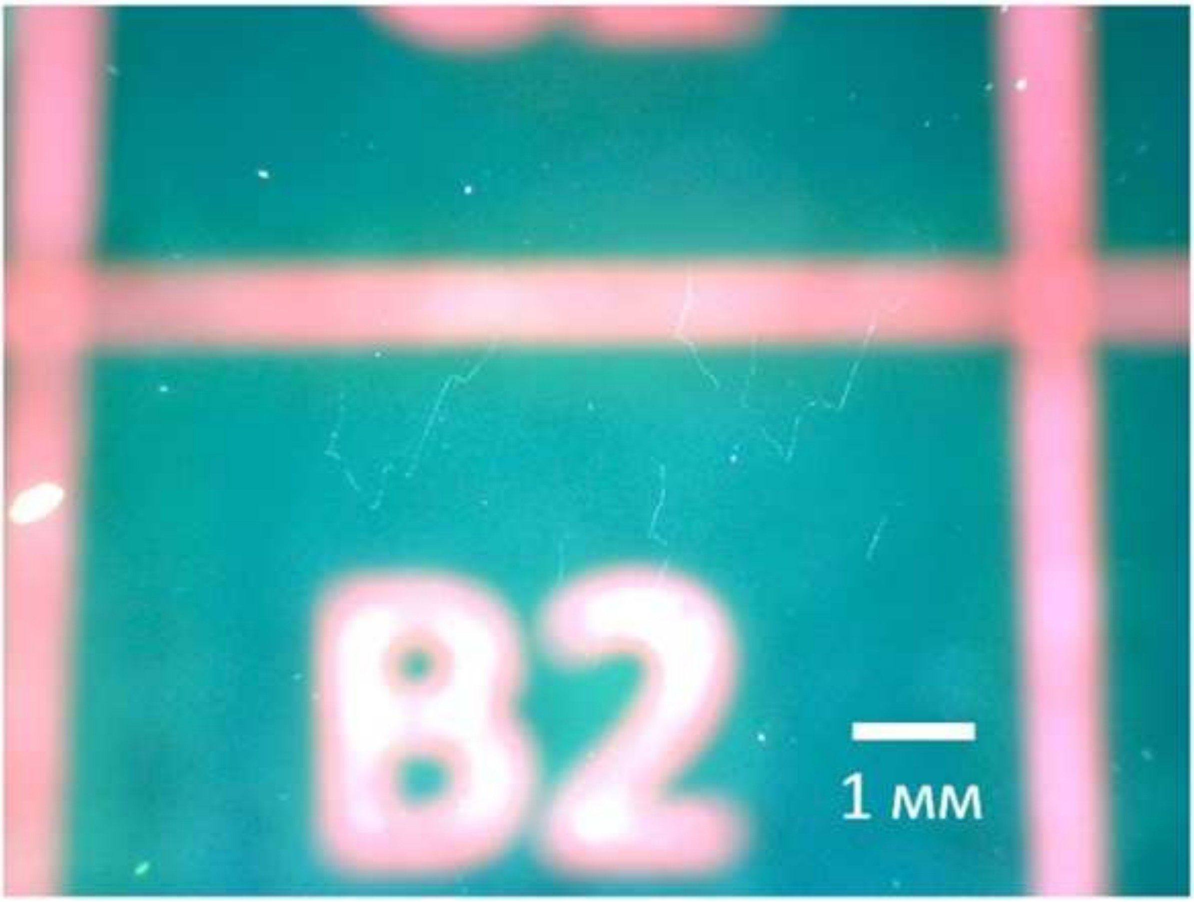
III Track examples

In order to acquaint readers with the main object of study – tracks of strange radiation, let us show some characteristic photos. In fig. 2 shows photos of mica areas – before exposure at reactors (a, b) and after (c, d). It can be seen that the original mica is either clear of the tracks (a), or has a small number of tracks (b), the source of which is unknown (judging by the date of manufacture on the pack, the mica was stored after production for about 30 years). After the exposure of the tracks many more groups of narrow lines, usually curved, several mm long, visible in lateral illumination, appeared (these tracks are especially well seen in dark-field microscopy).

Tracks are usually grouped in areas of about 1 cm2. A characteristic group of tracks on mica is shown in Fig. 3. Tracks within a group often have an identical form (for example, “boomerang” in Fig. 3). Twin tracks are localized within one group. Tracks in other groups have a different shape.



(a)



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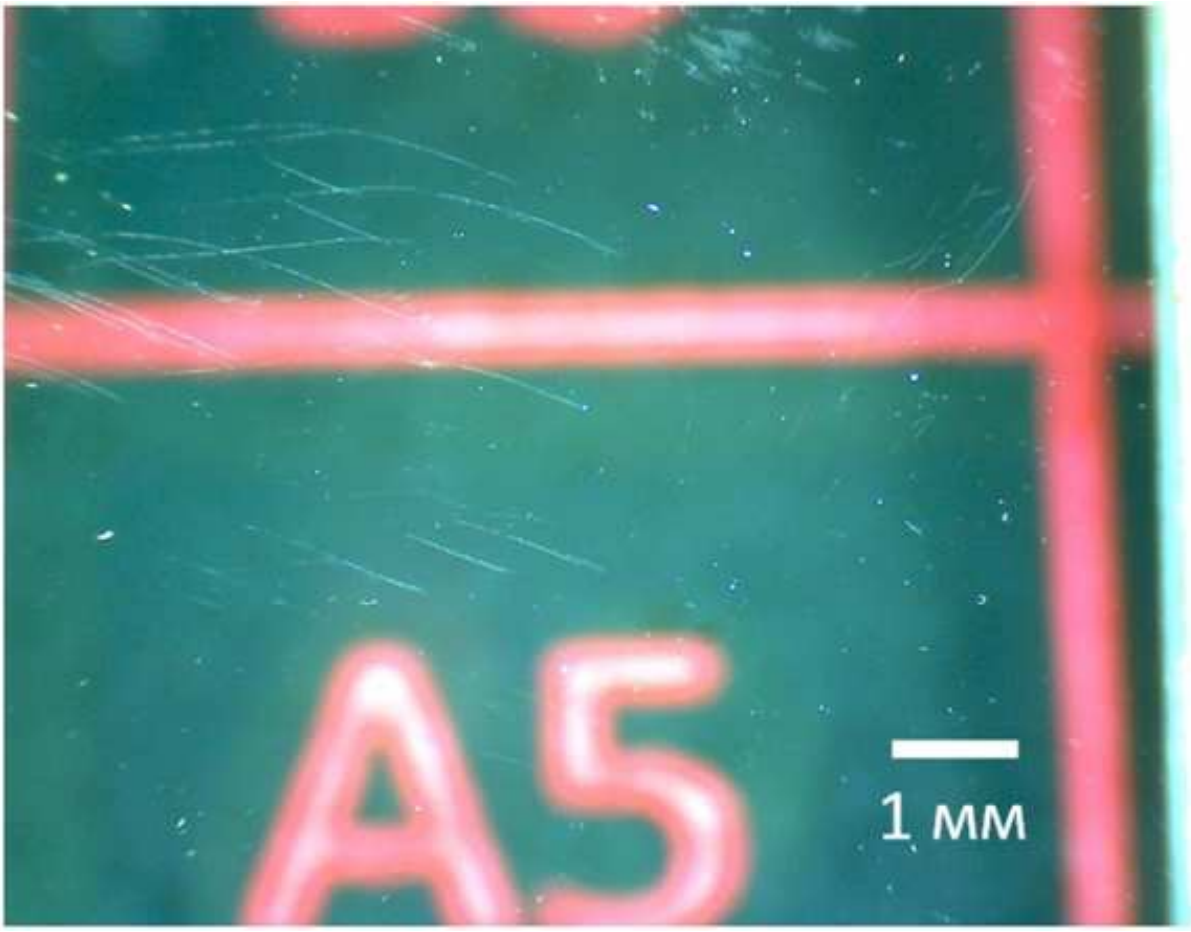
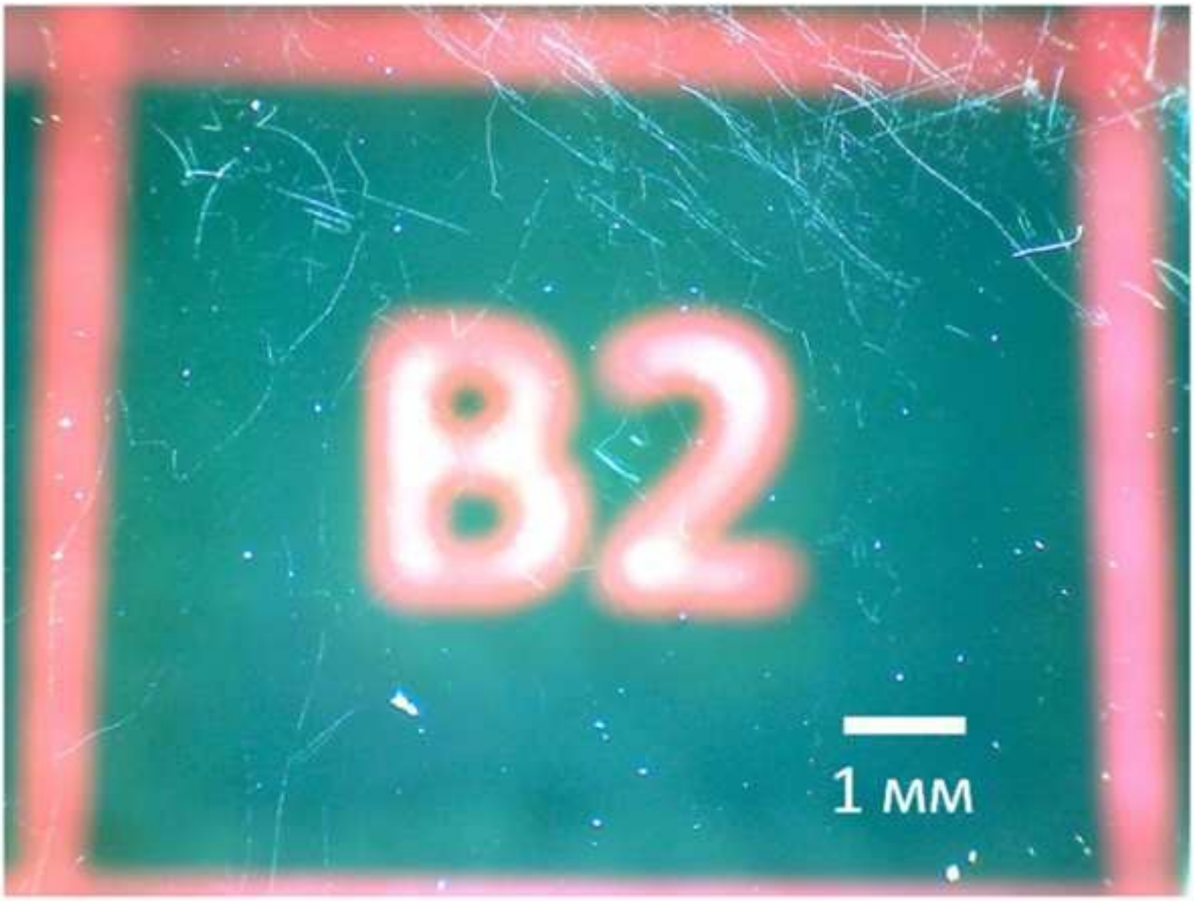


(c)



(d)

Fig. 2. Photos of mica before exposure (a, b) and after (c, d). Water reactor, distance 5 cm.

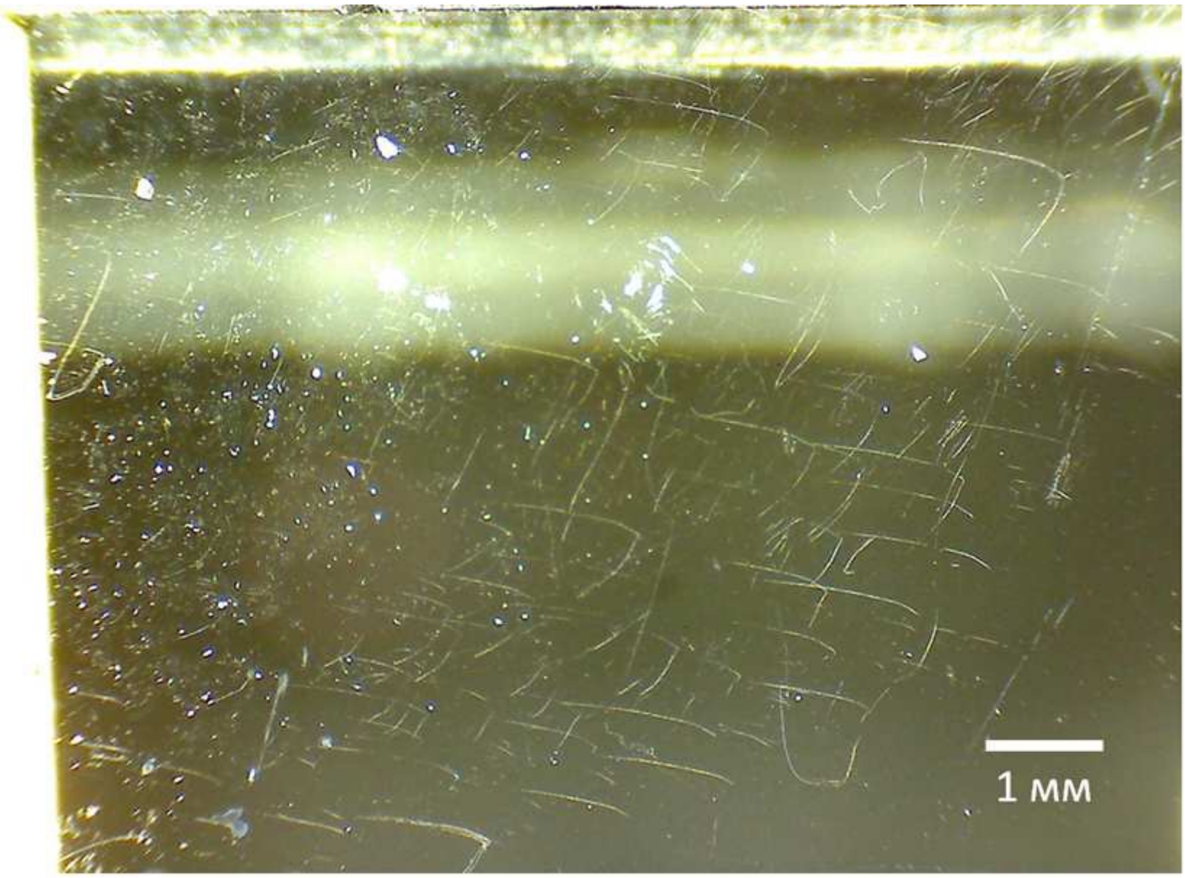
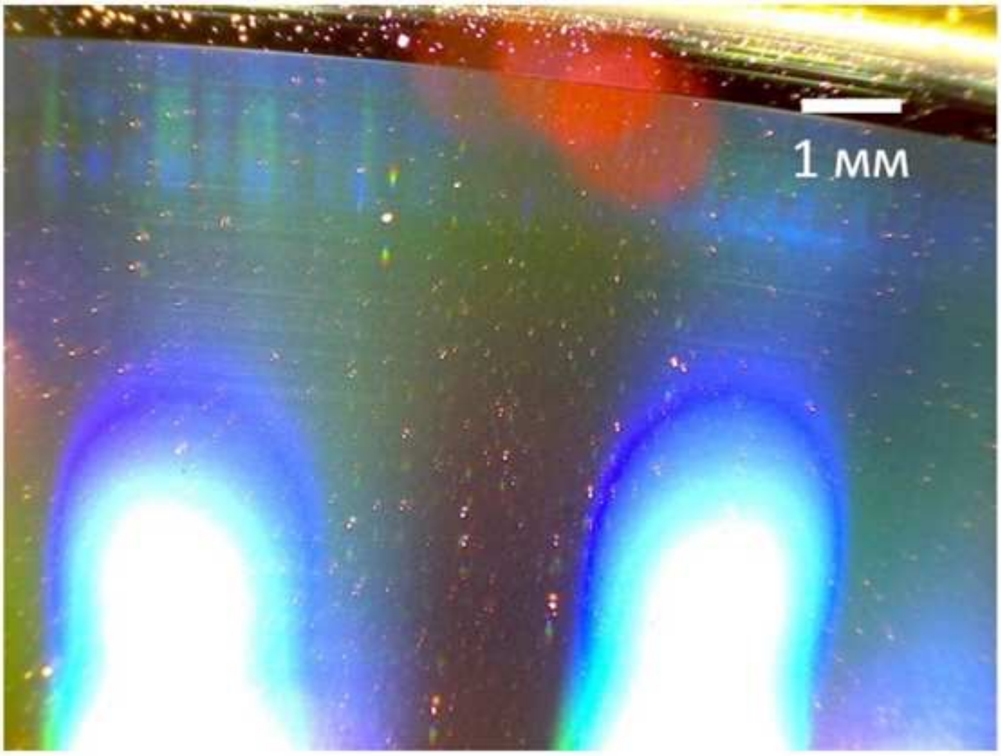
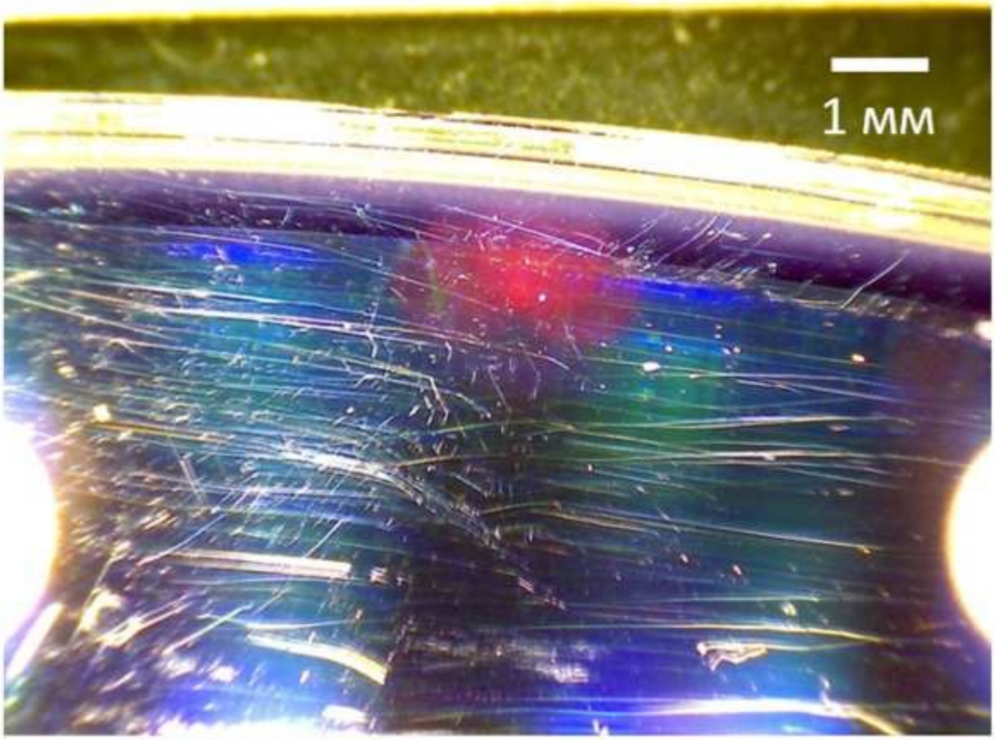


Fig. 3 Twin tracks on mica: the "boomerang" shape is repeated many times. Ni-H reactor, distance 5 cm.

Similar features of the tracks are observed on DVDs. Fig. 4 shows photos of control disks (a) and experiment (b) for comparison. There is also a large number of tracks in a group of about 1 cm2. They are mainly parallel tracks with a length of several mm. A more detailed analysis of the structure of the tracks is presented in Section 5 of this paper.



(a)



(b)

Fig. 4. Photo of the surface of DVDs. (a) - control (fume hood 2 m from the water reactor), (b) - 10 cm from the water.

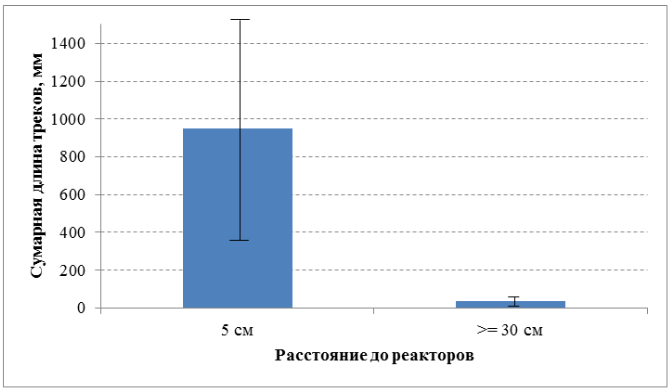
IV. Track statistics

This section presents the main results on the analysis of statistics for the total track length. Exposure conditions and summary results are presented in Table. I.

Data analysis shows that the total track length increases significantly near the reactors.

The mica and DVD results obtained near the reactors and away from them are shown in Fig. 5. In the following description, these areas are designated “near zone” (up to 20 cm) and “far zone” (more than 20 cm). In the far zone are also included control exposure with parallel control.

Sequential control showed that the total length of tracks on mica prior to exposure corresponds on average to parallel control, i.e. far zone. An analysis of the initial state of the DVD surface (before exposure) showed the complete absence of tracks.



(a)

(b)

Fig. 5. The average value of the total lengths of tracks for mica and DVD depending on proximity to the reactor. (a) for mica at a distance of 5 cm (5 exposures) and at distances from 30 cm (10 exposures); (b) - for DVDs at distances <20 cm (49 exposures) and at distances of > 20 cm (30 exposures). Intervals show average deviations.

The average total length of tracks on mica for distances of 5 cm from reactors (948 mm per sample) exceeds by more than an order of magnitude the average total length for large distances (37 mm per sample). In this case, there is a large scatter of values (the figure shows the average deviation[1]). In the far zone, there is also a large scatter, but in the expositions in the far zone there are completely no large values of track length sums (> 500 mm per sample).

The results on DVD are similar to those obtained for mica: an average of 980 mm per sample for the near zone (up to 20 cm from the reactors) and 54 mm per sample for the far zone (more than 20 cm). There is also a large scatter of values obtained both in the near zone and in the far, and the absence of large values for the far zone.

To illustrate the large scatter of data in Fig. 6 shows the total lengths of tracks for different DVD images, separately for near and far zones.

(a)

(b)

Fig. 6. The total length of the tracks on a DVD by exposure: (a) - for the near zone, (b) - for the far zone.

[1] Due to the large scatter of values by intervals on the figures, absolute values of the deviations of data points from the average are shown, rather than standard deviations, which are about 2 times larger.

Note that the data shown in Fig. 5 for the total lengths of tracks for mica and disks were obtained for different areas of the detectors. The area of the mica leaf is 25 cm2, the working area of the disk is 100 cm2. The average total length of tracks in the near zone turned out to be approximately the same, but the density of tracks (total length per cm2) for mica is 4 times greater. This difference may have several reasons.
First:
Different susceptibility of different materials with respect to strange radiation is possible. This difference may have several reasons.
Second: for mica, accumulation of tracks by both sides is possible, while for DVDs, tracks were analyzed only on one side, not covered by spraying and paint.
Third: the effectiveness of the method of counting tracks for a transparent material (mica) and for a material with a mirror inner side (DVD) may be different.

Table 1
Summary of track statistics on exposure conditions

	No. of Sample pieces.	**Amount length tracks mm**	**Hours of exposure**	**Hours of reactor operation**	**Avg. amounts length, mm**	**Density tracks mm / cm2**	**Speed accumulation tracks for exposure, mm / cm2 / h**	**Speed accumulation tracks over time reactor operation mm / cm2 / h**
MICA 50 x 50 mm								
5 cm from NI-H reactor	4	4096	1344	1344	1024	41.0	0.1219	0.1219
5 cm from water reactor	1	642	120	2	642	25.7	0.2140	12.8400
30 cm from Hi-H reactor	2	117	336	336	58.5	2.3	0.0139	0.0139
Fume hood (> 2 m from reactor)	4	107	672	0	26.75	1.1	0.0064	--
In the next room (> 5 m from reactor)	2	109	336	0	54.5	2.2	0.0130	--
Exposure in oven at 200°C	2	38	6	0	19	0.8	0.2533	--

DVD								
5-13 cm from NI-H reactor	7	3928	1440	1440	561	5.6	0.0272	0.0272
20-30 cm from Ni-H reactor	3	247	528	528	82	0.8	0.0047	0.0046
Up to 20 cm from water reactor	42	44089	7240	194	1050	10.5	0.0609	2.2726
20-60 cm from water reactor	15	513	2520	45	34	0.3	0.0020	0.1140
1 m from water reactor	5	757	512	27	151	1.5	0.0148	0.2804
Fume hood (> 2 m from reactor	7	116	595	0	17	0.2	0.0020	--

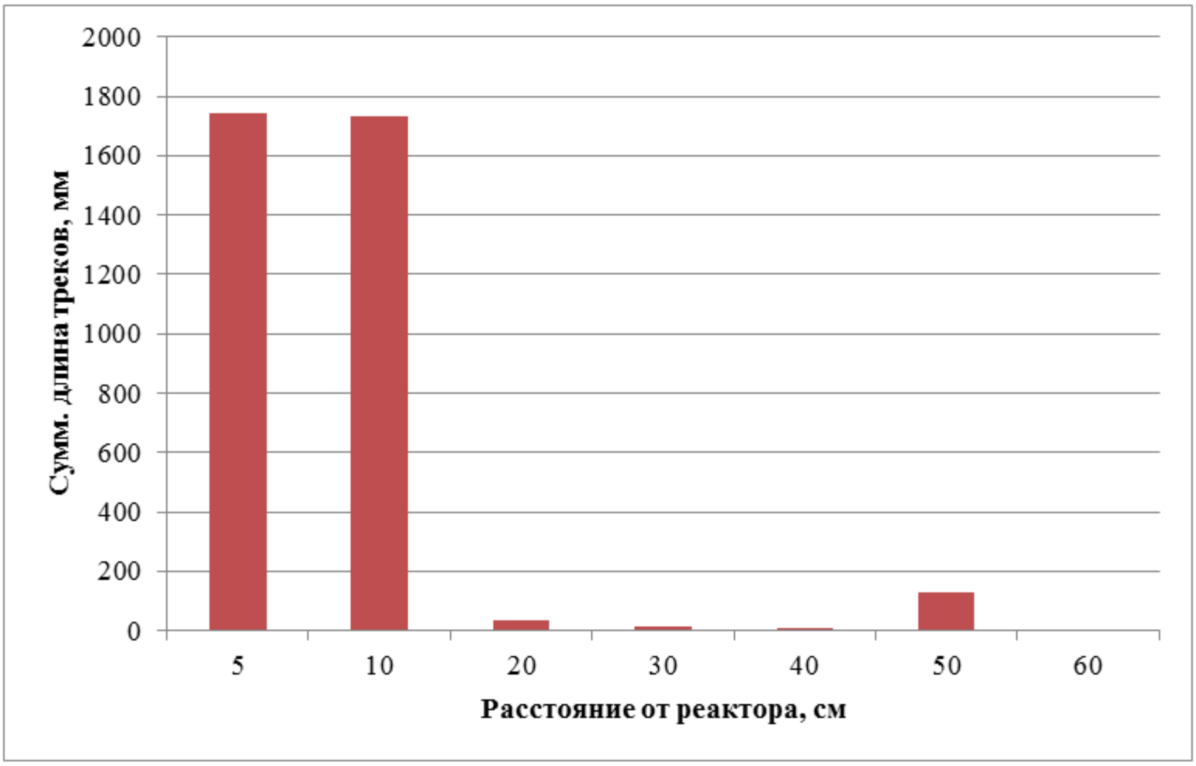


Fig. 7. The results of the experiment with different distances of the disks from the water reactor.

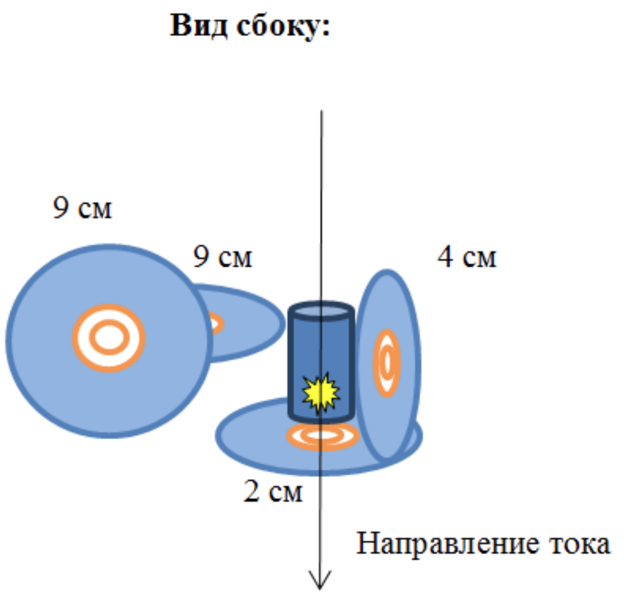
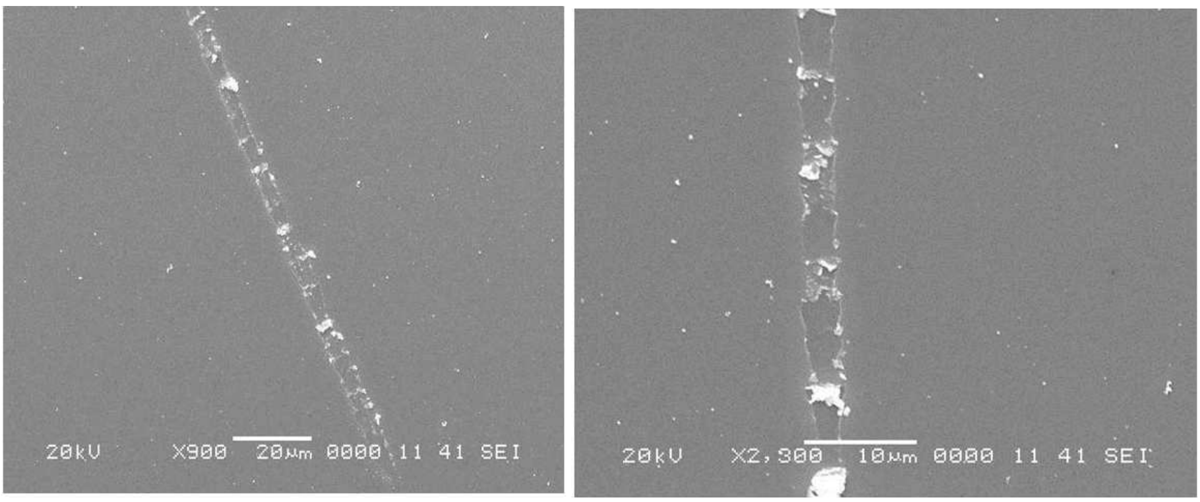


Fig. 8. Disc orientation and distance to disc centers from discharge.

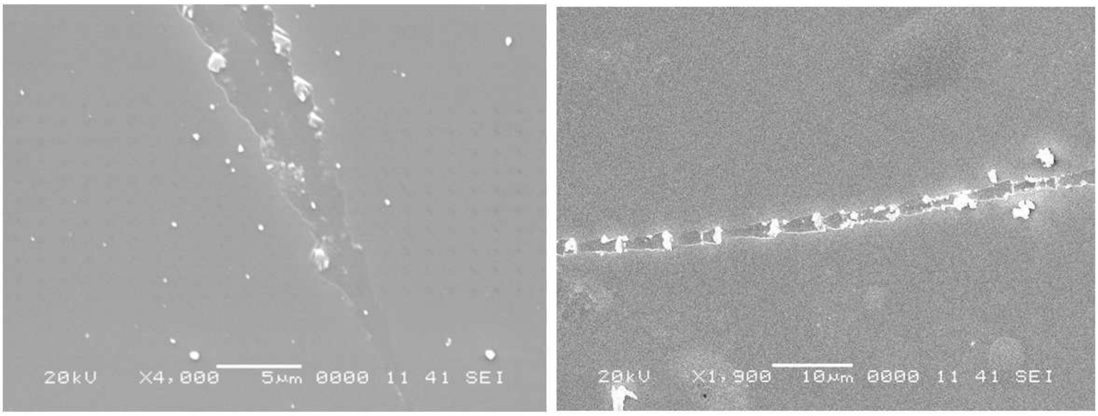
Fig. 9. Three repetitions of experiments with different orientation of the disks. Lozenges - the first repetition, squares - the second repetition, triangles - the third. The letters " В " and " Г " show the vertical and horizontal orientations of the disks for a distance of 9 cm.

To assess the nature of the dependence of the intensity of the tracks on the distance, an experiment was conducted, the results of which are shown in Fig. 7. Seven discs were placed at different distances from the water reactors. The disks, which stood at a distance of 5 and 10 cm, showed a large number of tracks; at a greater distance, the number of tracks fell by more than an order of magnitude.
Another feature of the results is as follows. The exposure time of samples from a continuously operating Ni-H reactor averaged one week. The exposure time of a water reactor can be considered in a different way. If we take the total time of its active work for the calendar time of one exposure, then it was usually several hours, while the samples themselves stood continuously at the reactor and during the hours when the reactor was not working (the calendar time on average is also one week).

Table I shows the total times for both continuous exposure and reactor operation. If we calculate separately the average track densities from Ni-H and the water reactors in the near zone (sums of track lengths divided by the total sample areas), we get similar values: 10.0 mm / cm2 for the Ni-H reactor and 10.6 mm / cm2 for a water reactor. However, if you divide them by the time of active work and get the rate of accumulation of tracks during the active work of the reactors, it turns out that water reactor in one hour of work produces tracks an order of magnitude more (0.0540 mm / cm2 / h for a water reactor, 0.0036 mm / cm2 h for a Ni-H reactor). We cannot yet draw an unambiguous conclusion here, because it is possible that strange radiation accumulates in the water during the reactor operation and gradually comes out of it [1]. More research is needed to clarify the situation.



(a) (b)



(c) (d)

Fig. 10. SEM (scanning electron microscope) images of tracks on the mica surface.

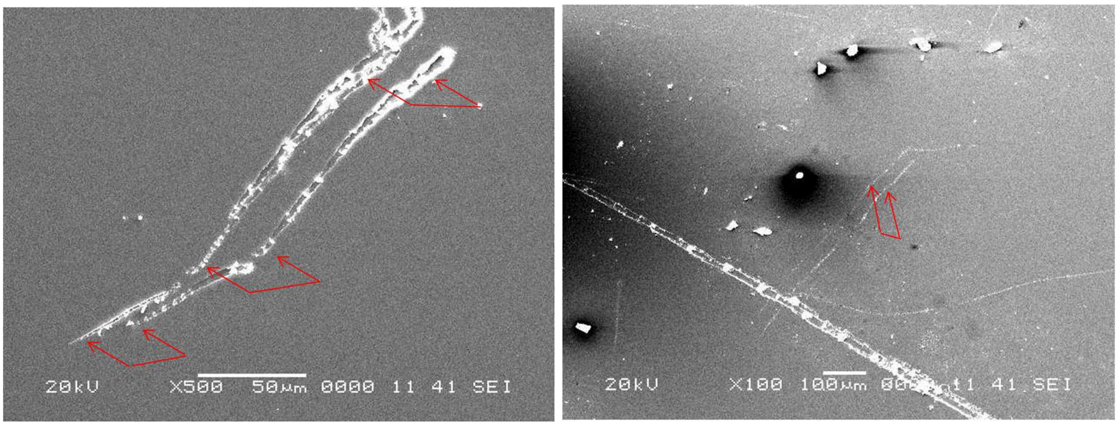
Experiments were also carried out with different orientation of the disks with respect to the water reactor in the near zone. For three experiments with the same placement conditions for 4 disks around the reactor, a diagram of the total track lengths was constructed. The orientation of the disks and the distance from the core to the centers of the disks in each experiment are shown in Fig. 8.
The sensitive side of the disks at a distance of 2 and 4 cm was directed to the discharge.

The values of the total lengths of the tracks are shown in Fig.
9. If we analyze the dependence on distance, we see that the average for the sum of the lengths of the tracks is approximately the same - about 600 mm per disc for three distances (2, 4, 9 cm) with a large spread. There are also no patterns in the accumulation of tracks by discs depending on their orientation (for a distance of 9 cm, vertical (c) and horizontal (d) orientations are shown). The reactor operation time in two repetitions - 3 hours, in the third - 4 hours.

V. Track structure

A. Tracks on mica

We will begin to consider the structure of the tracks with mica images on a scanning electron microscope (SEM). Mica was exposed at a distance of 5 cm from the operating Ni – H reactor, the exposure time was 890 h.
The tracks (Fig. 10) are extended traces of the destruction of the surface, as if a solid object scratched the surface, periodically raking and then leaving the dispersed material of the sample on the way. Near the tracks, fine particles <0.5 microns of the same material (mica), possibly ejected from the track, are visible on the mica surface. The width of the tracks varies from 3 to 20 microns. The beginning of one of the tracks is shown in fig. 10c.



(a) (b)

Fig. 11. Examples of parallel tracks (SEM images).

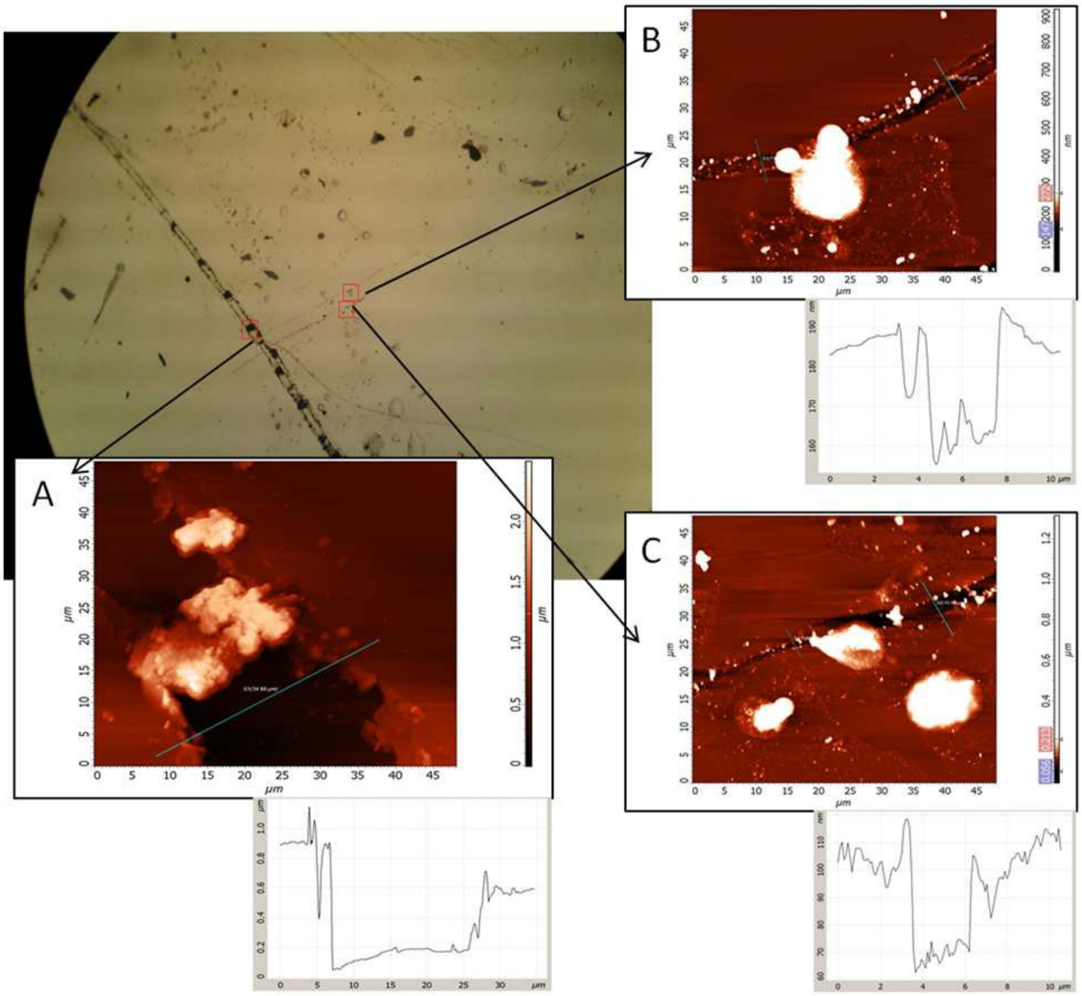
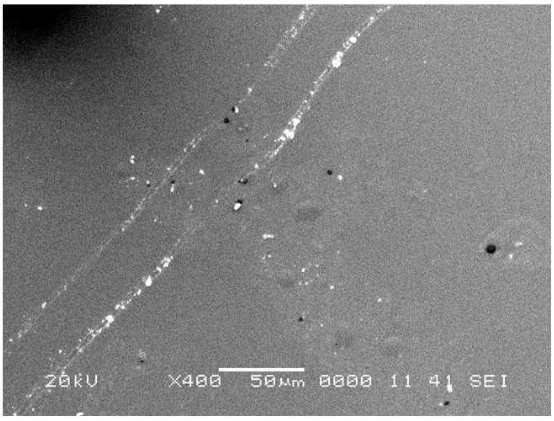
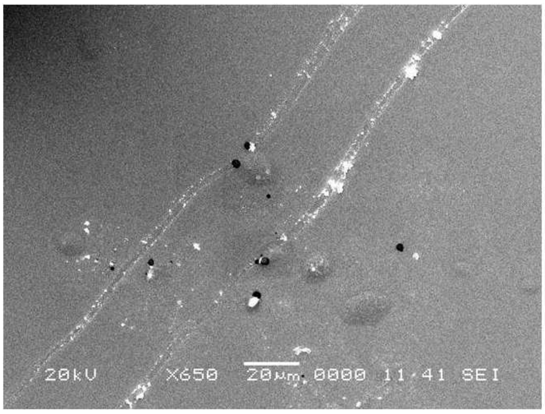
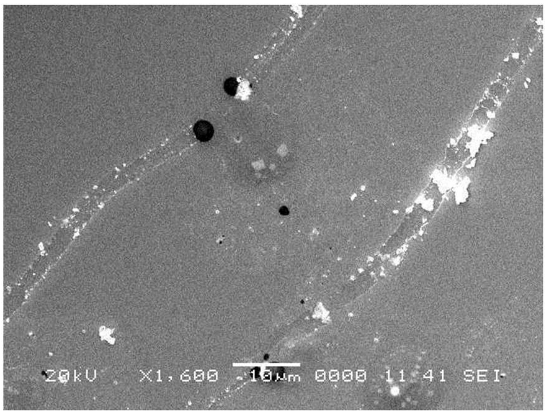


Fig. 12. Optical image and AFM images of three tracks fragments on mica.



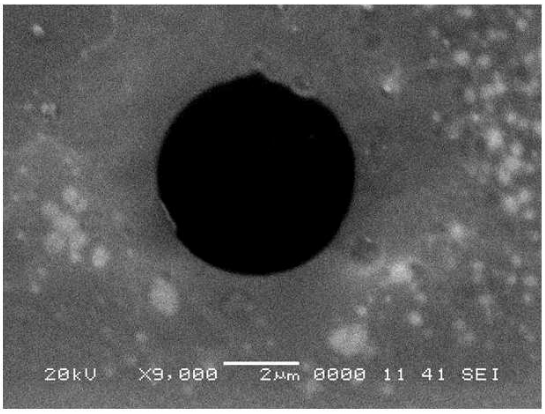


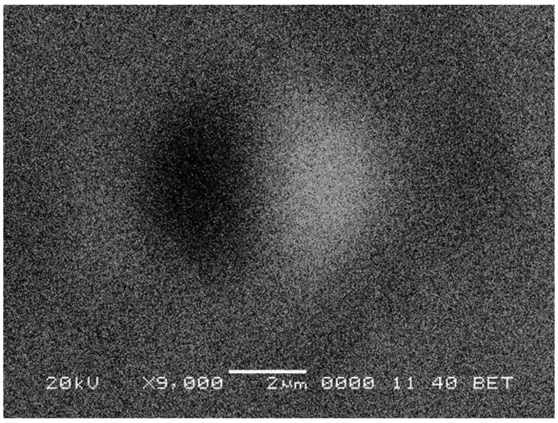
(a) (b)



(c)

Fig. 13. Contrasting black spots (different scale).





(a) (b)

Fig. 14. *a - Electronic image of an even round spot with a diameter of 5 µm;*
b - the corresponding relief image (corresponds to the bulge).

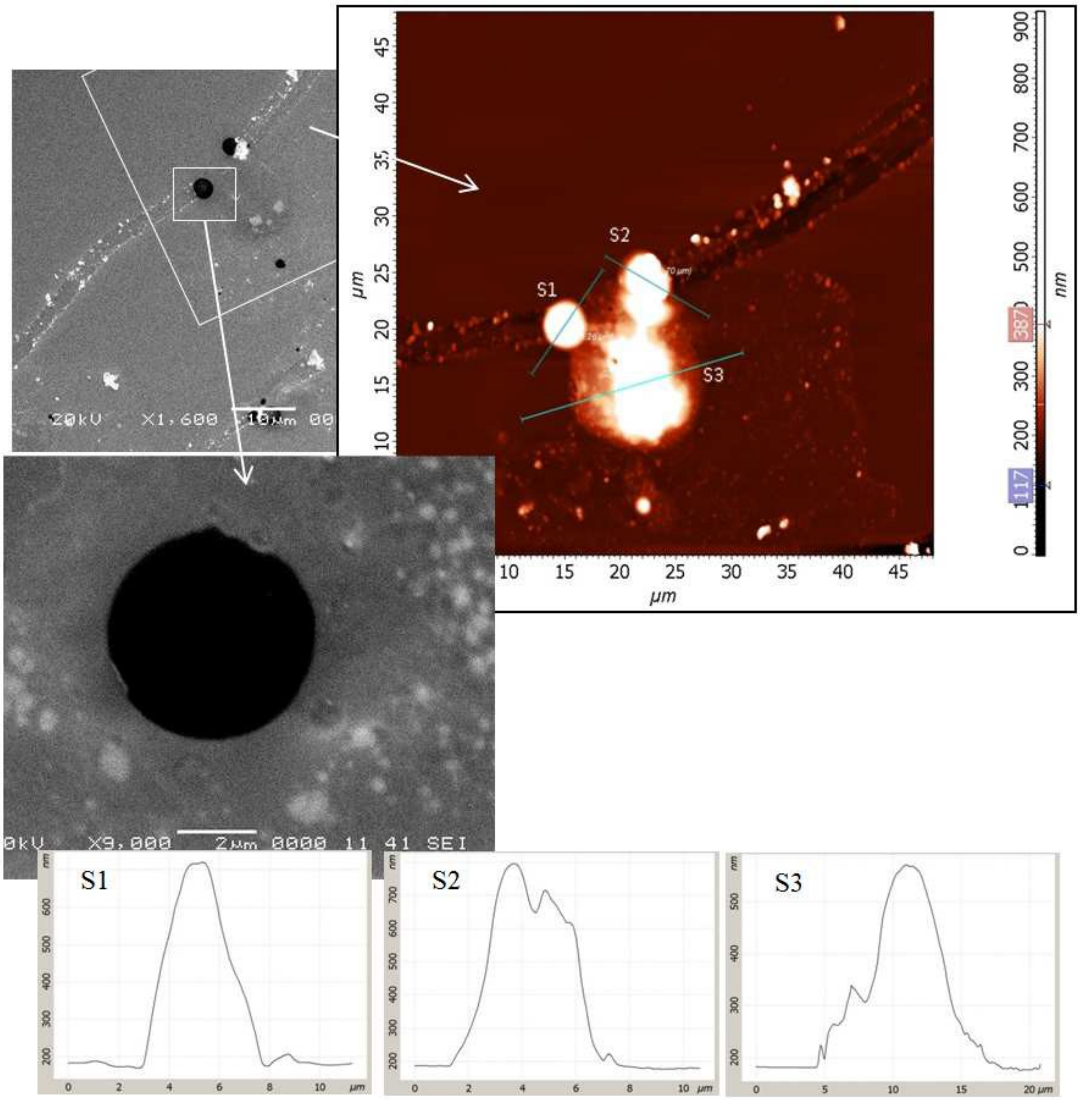


Fig. 15. SEM, AFM image and three profilograms of contrasting spots.

In fig. 11 we have examples of twin tracks, when the distance between the tracks is 20–50 microns. Tracks repeat their form (one track can be obtained from the other by a parallel transfer), but their microstructure is different, i.e. details of the order of 1 μm along the tracks are different.

Atomic force microscopy (AFM) was used to investigate the track profile. AFM images, including profilegrams, are shown in fig. 12. Shows the location on the optical photograph of areas taken on AFM; the place is the same as in fig.11 below. The pictures show a rather wide track, its width is about 20 microns, depth - 0.4–0.8 microns, and several tracks 2.5–3 microns wide and 30 nm deep.

B. Contrast SEM black spots on mica

During the detailed analysis of the mica sample in the area of double tracks (sections B and C in Fig. 12), contrasting black spots measuring 1–7 μm were seen on the CEM (Fig. 13).

At first it was suggested that these are craters. A more detailed analysis of the relief showed that these are convex formations (Fig. 14). Attention is drawn to the correct round shape of the spot with a diameter of 5 microns. It was also interesting that part of these spots lay at the beginning / end of the tracks, and their size corresponded to the width of the tracks. The height of the bulge spots in Fig. 14 could not be identified at SEM, but it turned out to be possible with the help of AFM (Fig. 15). The height was about 500 nm.

A similar profile measurement was performed for contrasting spots at the adjacent track (Fig. 16). The height of the contrasting dark formations here was 600–700 nm.

To clarify the nature of these spots, an elemental analysis of a round spot by an energy dispersive method was performed (Fig. 17). Significant changes in the elemental composition compared with the point of comparison were found.

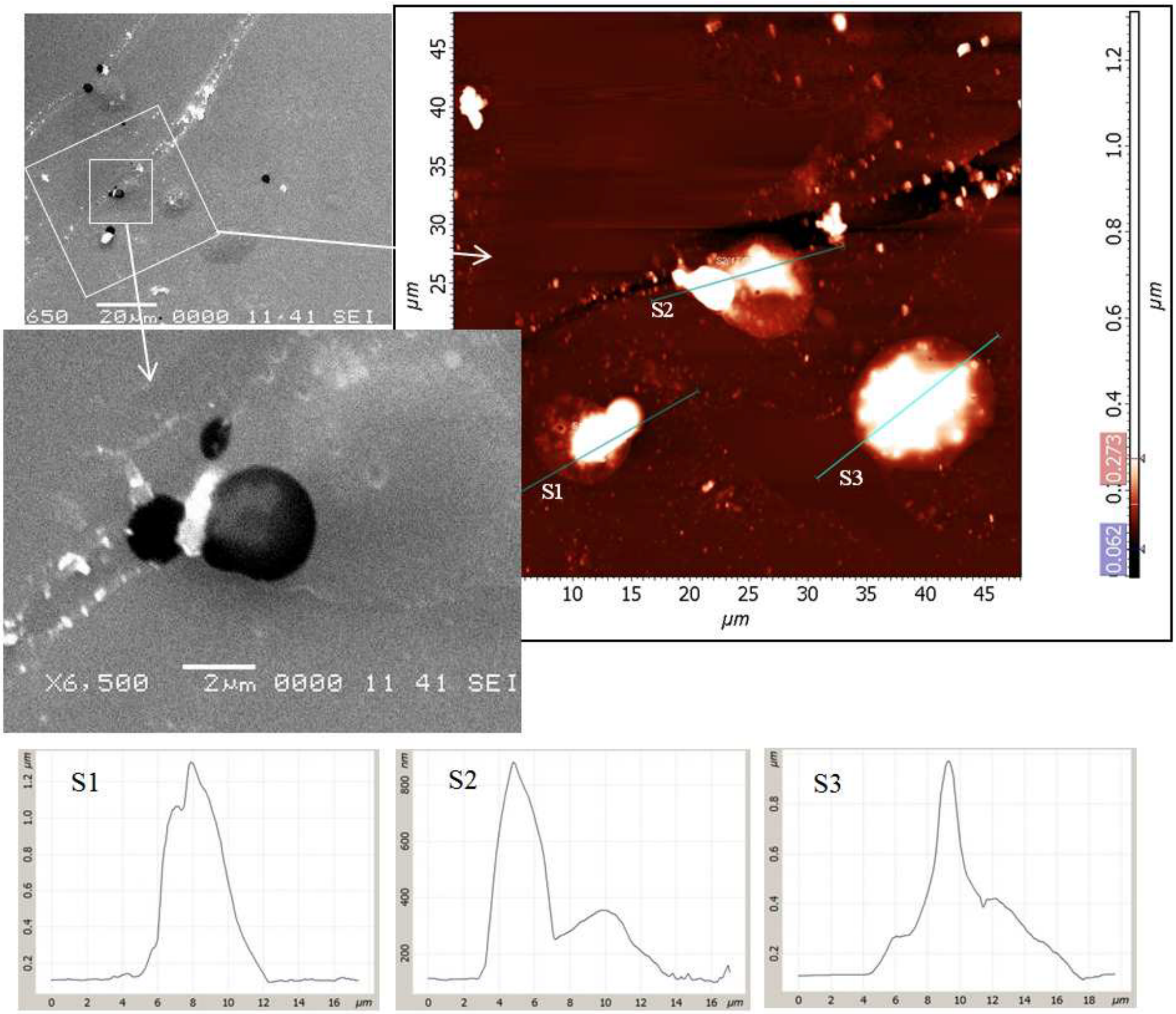
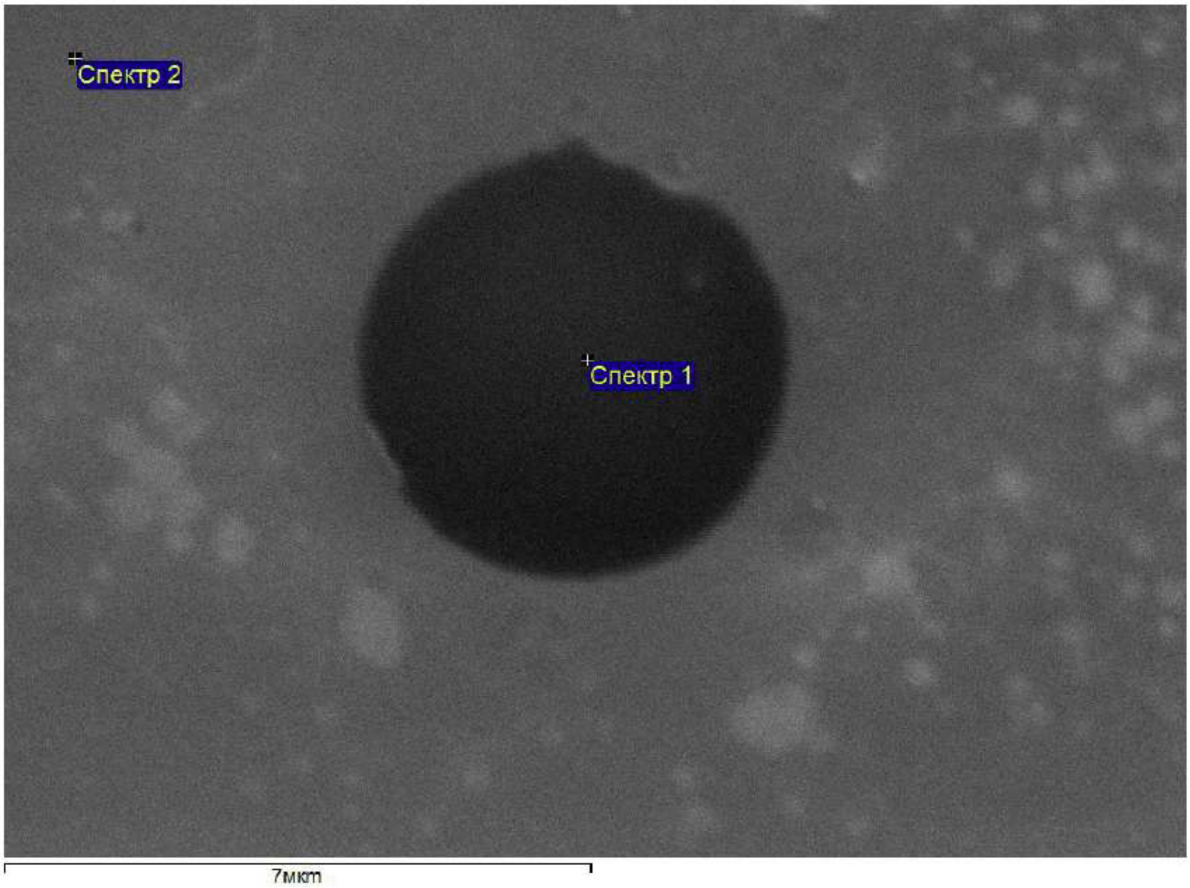


Fig. 16. Detailed image of other contrasting spots.

Some difference in the elemental composition of a spot from a point outside the spot is that it has a higher carbon content (56 vs. 33 at.%) And Na (1.16 vs. 0.31 at.%). Performed elemental analysis in other points inside the tracks, both at the bottom of the tracks and in the collected dispersed “dumps”, as well as away from the tracks. No significant deviations from muscovite composition were found. Particles less than a micron, scattered over the surface, are either particles of muscovite (they have the corresponding elemental composition) or particles of organic origin. More research is needed to find out the origin of carbon at all points analyzed, incl. away from the tracks.

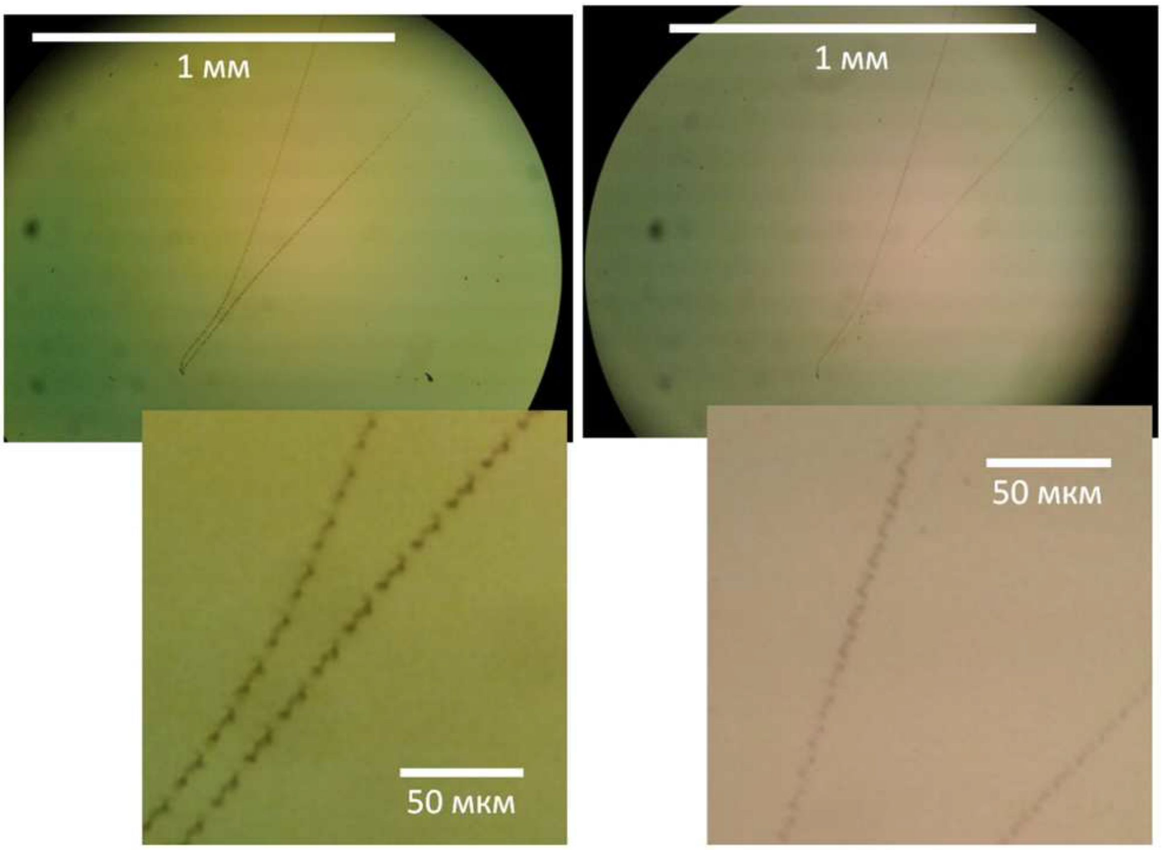


Спектр	C	O	F	Na	Mg	Al	Si	S	Cl	K	Ti	Fe
Спектр 1	56,99	27,69		1,16	0,15	5,95	5,55	0,09	0,18	2,07		0,18
Спектр 2	33,49	45,15	0,89	0,31	0,17	9	8,11			2,59	0,04	0,25

Fig. 17. Elemental analysis of a round spot with a diameter of 5 microns.

C. The structure of the tracks on DVD, located near the installation with plasma electrolysis

To analyze the tracks on a DVD, consider two twin tracks (Figure 18). These tracks, located within one group, have an identical form. Next to these two tracks were other copies of them (not shown in the figure). With a higher magnification in the optical microscope, it is clear that both of these tracks have a periodic structure. Moreover, if the shape of the tracks on a scale of 1 mm is identical, then their periodic microstructure differs in both pitch and pattern (Fig. 18 a, b)



(a) (b)

Fig. 18. Optical image of two twin tracks on DVD.

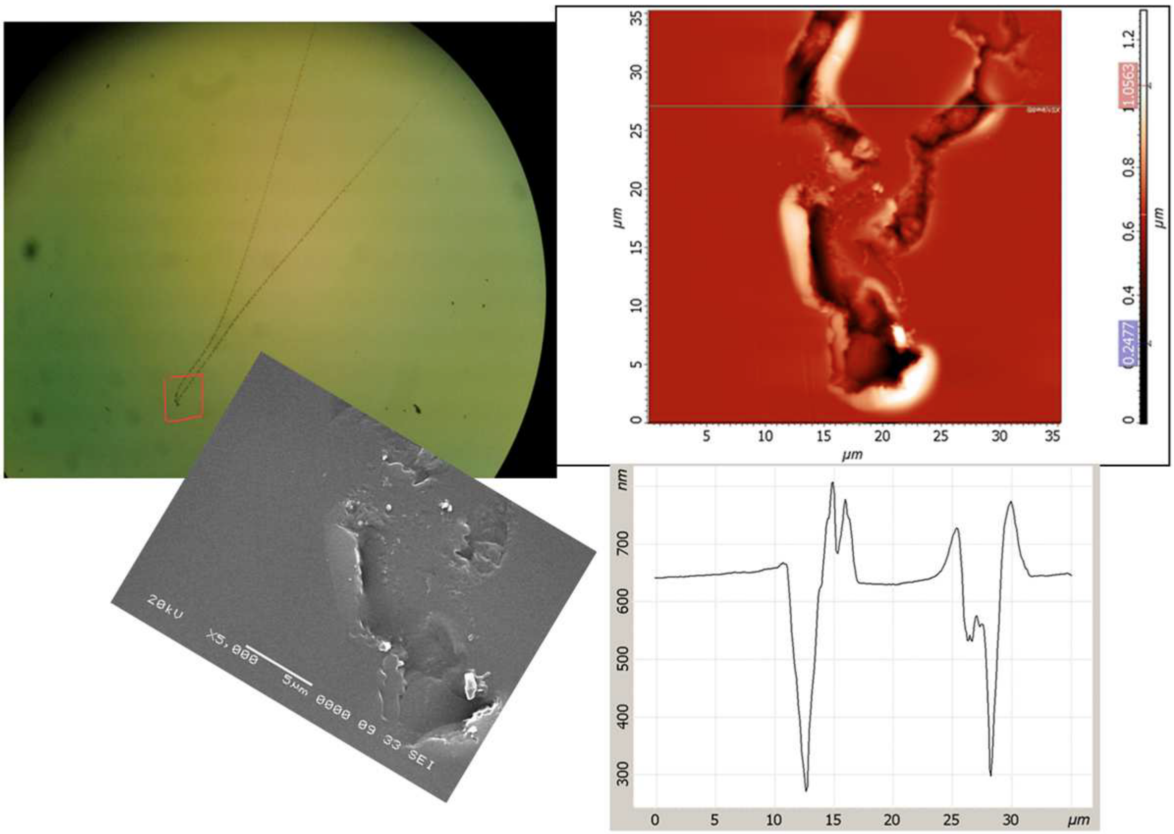
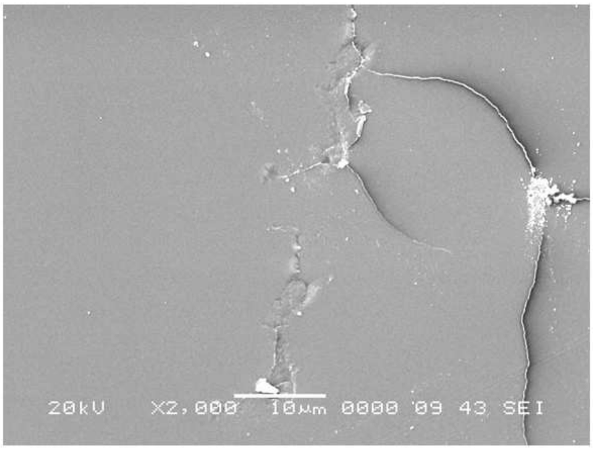


Fig. 19. Optical, SEM and AFM images of a fragment of a track on a DVD.

A more detailed examination of the structure of one of tracks shown in Fig. 19. A fragment of the track is shown here, which is either a turning point in movement or a point of expansion. The study was performed using an electron microscope, as well as AFM. The profilogram of an atomic force microscope allows you to determine the typical depth of the track - it is about 300 nm. The width of the lines of the twin tracks is 7 microns.

An interesting was the SEM-image of a periodic structure (Fig. 20). The track period is about 25 µm for the track in fig. 18a and 18 microns for the track in fig. 18b. Moreover, a comparison of the “print” pattern repeating along both branches of the track in fig. 18a, allows us to talk about their identity in detail, both along each branch and between the branches. In fig. 21 shows these identical fragments of the two branches at higher magnification. Comparison of individual image details shows that within the resolution of an electron microscope (here - tens of nm) it is one and the same picture, as if the same solid body left its imprint many times (see inset in Fig. 21). The period of the structure is maintained throughout the track. The same self-similar in detail traces were observed for the periodic micro-structure in Fig. 18b.
Near the periodic tracks in the electron microscope, cracks were found in the material of disks up to tens of microns in size (Fig. 22).
However, it should be noted that periodic tracks make up only a small part of the tracks on DVD (about 5–10%). Most tracks are smooth lines running parallel to each other within the same group. Sometimes there are continuous tracks, turning into periodic (Fig. 23).

A group of twin tracks with periodic fragments is shown in fig. 24.



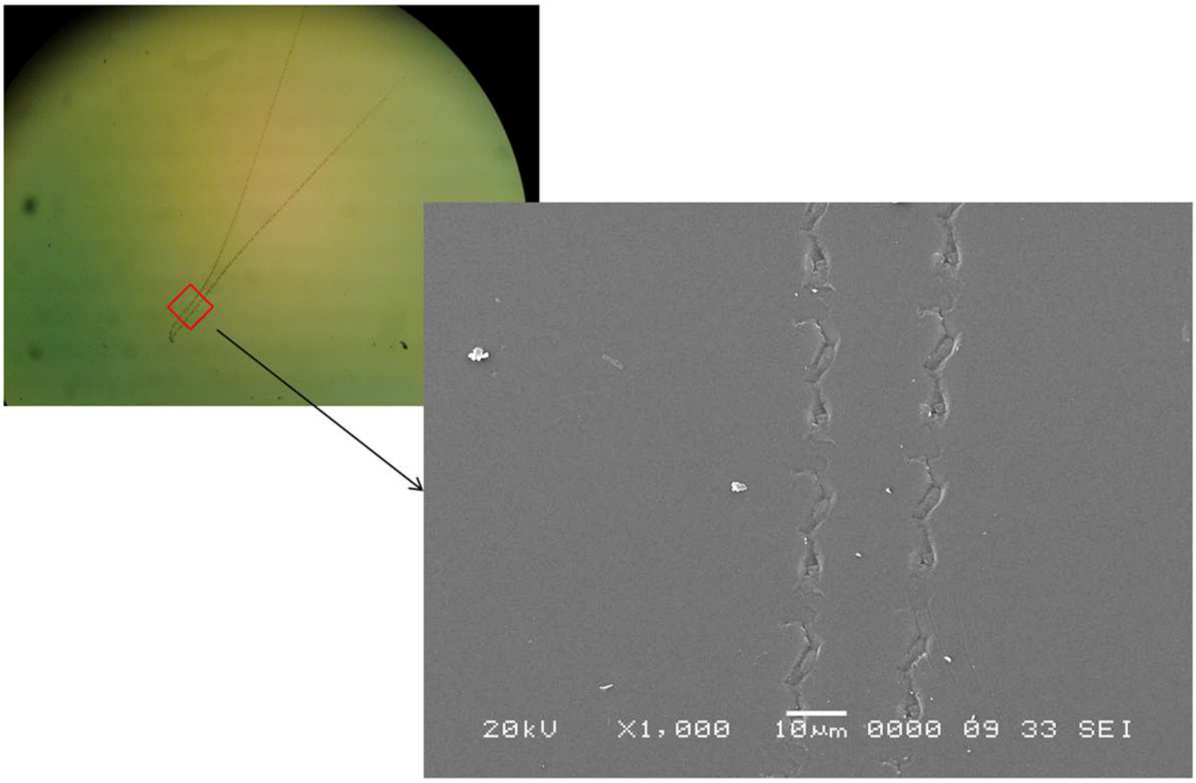


Fig. 20. Optical and SEM image of a fragment of a track on DVD.

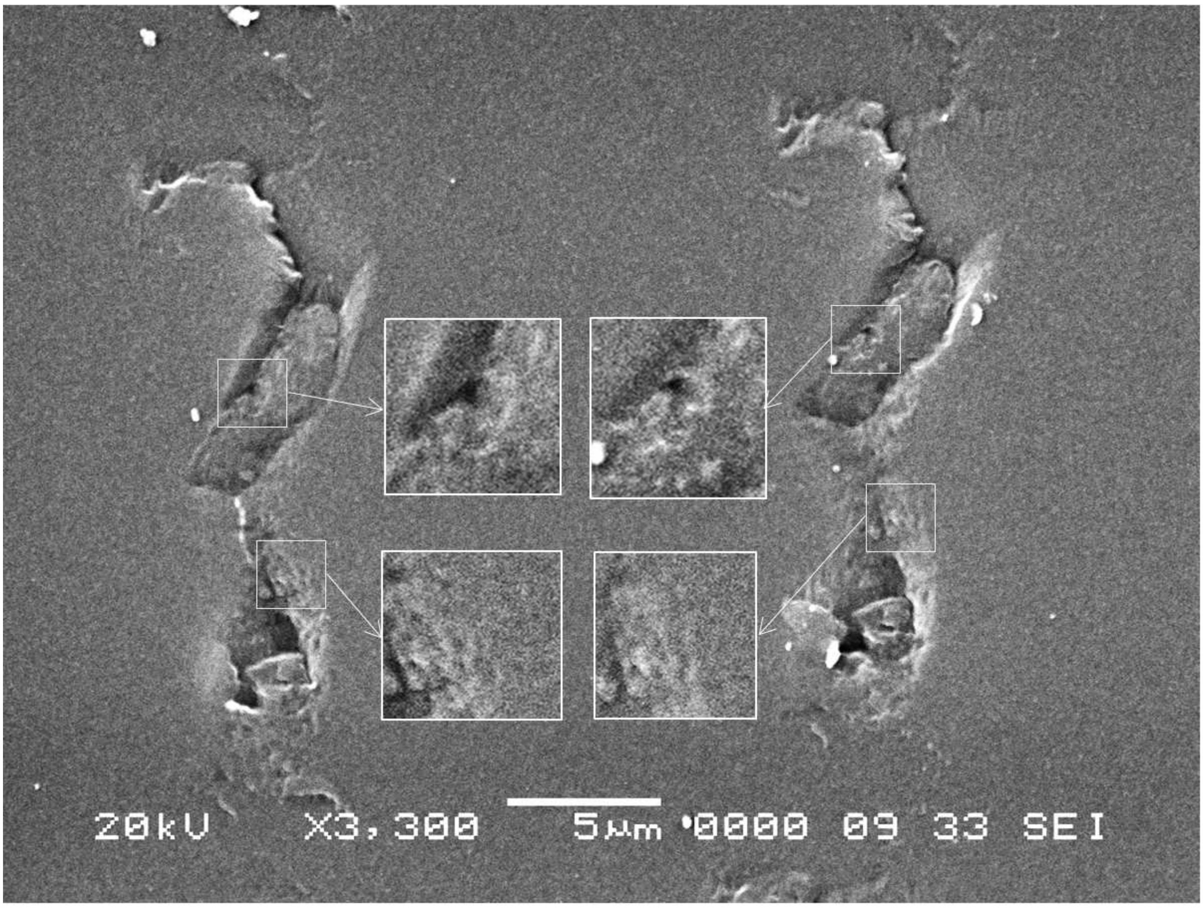


Fig. 21. Detailed SEM image of a track fragment on DVD (contrast increased). Explanations in the text.

The elemental analysis was performed by the energy dispersive method for the deepest place in the track in Fig. 19 (the point of distribution or reflection of the branches of the track), as well as along the track in fig. 18b. No extraneous elements for polycarbonate were found. Only carbon and oxygen are detected.

VI. Discussion

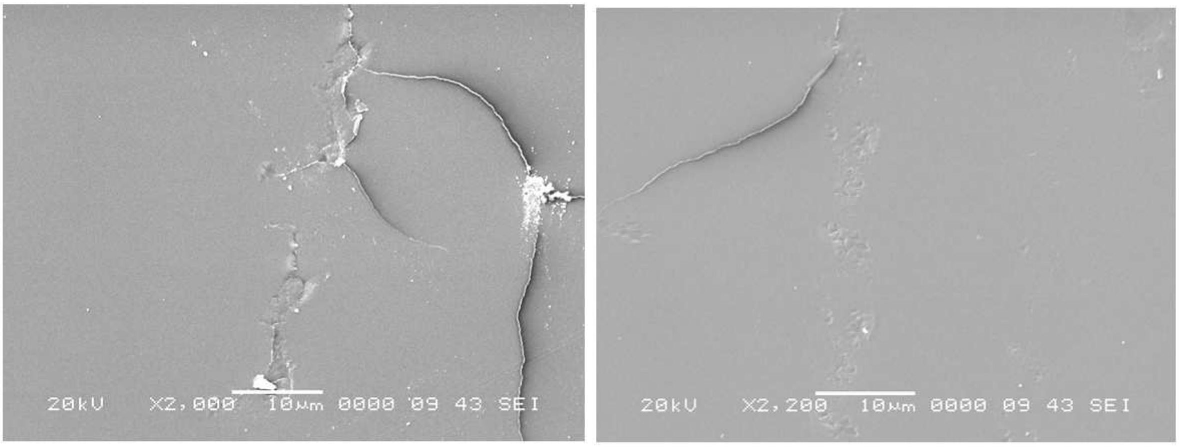
The first thing to consider when it comes to tracks of strange radiation: do they really represent something "strange", or is it just scratches? They are related to scratches because they are located strictly on the surface of the samples. But the tracks of strange radiation have a number of properties that distinguish them from ordinary scratches:

1) They appear in large quantities only in the near zone of reactors (up to 20 cm) with the same processing technique for experience and control;

2) They are grouped into clusters of about 1 cm2;

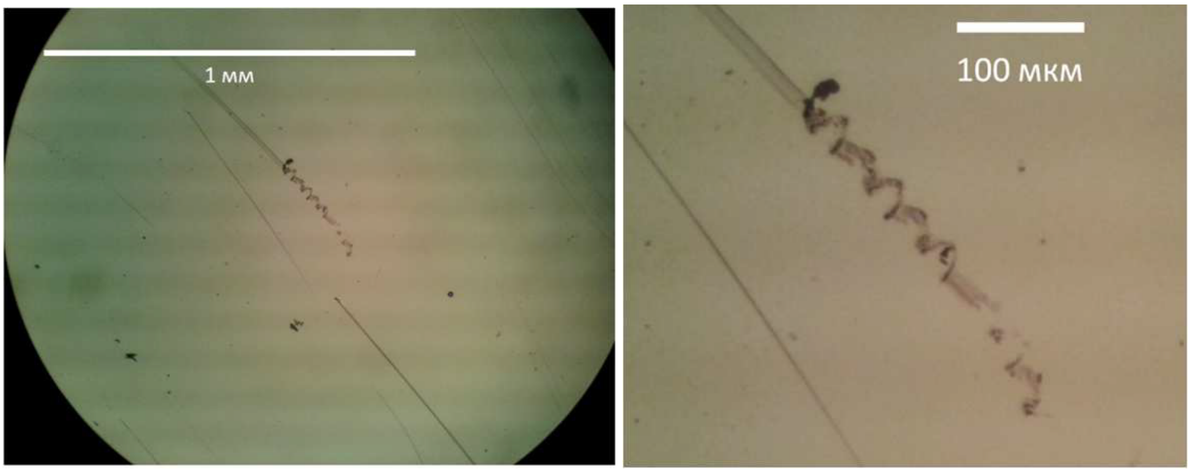
3) Within the same group, they run in parallel, being a copy of each other, regardless of the complexity of the shape of the trajectory;

4) They sometimes have a periodic structure; within the framework of this structure, the accuracy of pattern matching between periods is at least tens of nanometers.



(a) (b)

Fig. 22. Cracks on the DVD surface next to periodic tracks.



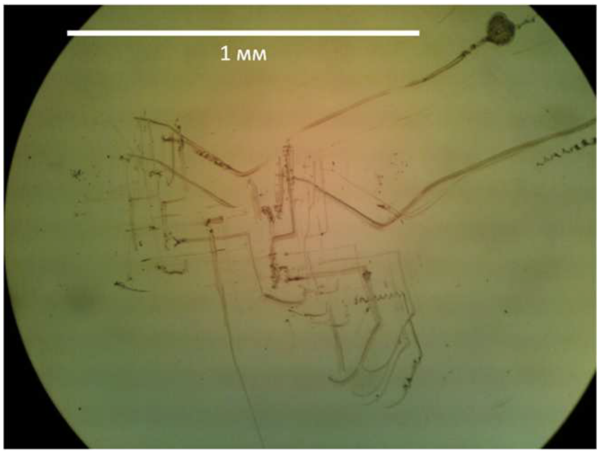
(a) (b)

Fig. 23. Linear track, turning into a periodic (or vice versa). Optical microscope.

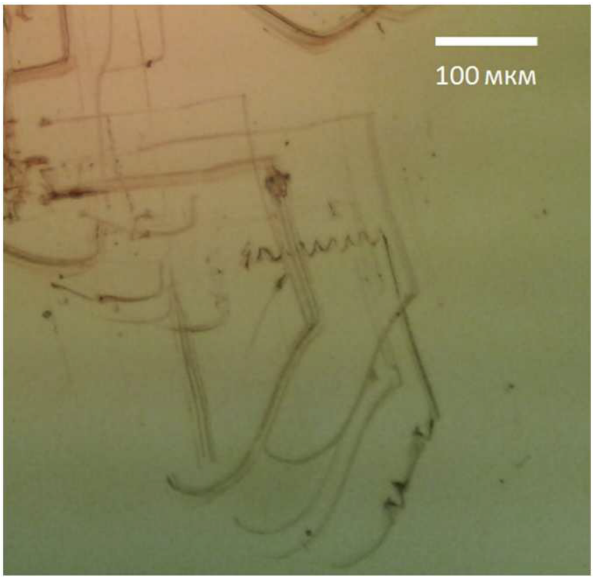
These oddities in the behavior of the tracks suggest their unusual origin.

Despite the fact that the main tracks in this study appear from the reactors, however, with the exposure of samples in any other place, a small number of tracks also appear. By their properties, these tracks are similar to tracks from reactors, but they, as a rule, are not grouped, but are single tracks. Such background tracks were seen in the source materials, for example, in mica that had lain for about 30 years from the time of production. Accounting for background radiation using sequential and parallel control is mandatory in the applied method.

In this case, the origin of the background radiation remains unexplained.



(a)



(b)

Fig. 24. A group of twin tracks consisting of smooth and periodic sites. Optical microscope.

A significant feature of the tracks of strange radiation is the variability of the intensity of their appearance over time. Despite the fact that the Ni-H reactor worked for months in a stable mode, the tracks in its near zone sometimes appeared with great intensity, then almost disappeared, with equal geometry and exposure time. The same behavior was typical for plasma electrolysis reactors.
However, in these experiments, the scatter of data could also be associated with differences in the designs and operating modes of the used reactors. The search for reasons for the variations continues. An interesting parallel is the results of the study of variations in biotransmutations with time [21].

Another significant feature is the uneven distribution of tracks on the surface of the detectors both within the same sample and between different samples that are simultaneously in the near zone of the reactors. As already mentioned, the tracks are mainly collected in local groups. Twin tracks with exact coincidence of form are only within one group. Although not all parts of the tracks are equally "printed" in the samples, nevertheless, the overall shape can

be accurately determined even by fragment. The number of twin tracks can reach dozens in one group.
The appearance of tracks, so uneven in time and space, indicates a random process that depends not only on the operation of the reactors, but also on some external, as yet unknown factor.

Perhaps the most intriguing feature of strange radiation tracks is the occasionally arising periodic microstructure. An important observation is the following. While the macrostructure of twin tracks is the same (on a scale of about 1 mm), their microstructure (on a scale of about 10 microns) differs from track to track. This is true not only for periodic tracks (see the difference in periods and micro-patterns for figures 18a and 18b), but also for smooth tracks. For example, the width of the twin tracks in Fig. 24 is different, and only in one of the tracks identical in form, the transition from a smooth structure to a periodic one and back appears.
Attention is also drawn to the different character of surface damage in various materials. In mica, this is the “scratching” of the layers; AFM shows that the bottom of such tracks is flat (this is probably the plane of the next layer of mica), and the material is collected in loose heaps, periodically left along the track. In polycarbonate material is being pushed through; profilograms show that, along with the indentations, there are fragments protruding above the surface (material extruded from the tracks). In addition, the appearance of cracks in polycarbonate in the track area (Fig. 22) indicates high pressures on the surface during the formation of periodic tracks.
The ratio of depth to width of tracks is small: for both mica and polycarbonate it is about the same value of 1–4%. Observations have shown that tracks on mica are not strictly periodic. One can observe only an approximate periodicity in raking and leaving the dispersed material along the track. In glass, films, plastic there are strictly periodic tracks.
The origin of the particles leaving the tracks, their nature, the reason for their synchronous movement and periodicity, as well as the nature of the strange radiation in general, remain unclear. The discussion of hypotheses deserves a separate publication. The “contrasting spots” of regular shape that we found, the size of which roughly corresponds to the width of the tracks, pose new questions. To clarify the nature of the tracks, further detailed studies of their structure are needed. Let us return to the question posed at the beginning of the article. Are the work of LENR reactors and the tracks of strange radiation? Statistics gives an affirmative answer to this question. Tracks are formed by one or two orders of magnitude more intensely in the near zone of the reactors.
However, if we consider the stronger hypothesis that the tracks are associated precisely with LENR reactions inside the reactors (let's call it a strong hypothesis), then the results of this work, although they do not contradict this hypothesis, nevertheless do not prove it strictly.
To prove this hypothesis, it is necessary to study the possibility of the appearance of tracks from other factors involved in the work of LENR reactors (electric current, electromagnetic fields, high temperature, sorption / desorption, phase transformations, etc.), as well as to conduct tests of reactors in no flow modes nuclear reactions, but otherwise involving these factors. Although the proof of a strong hypothesis is still relevant, we still leave this problem “in the rear”. From a practical point of view, and especially from the point of view of safety issues, it is necessary to take into account the fact that operating LENR reactors based on two typical processes — heating of hydrogen-hardened metals and plasma electrolysis in water — are sources of strange radiation tracks. Questions of protection from strange radiation, the

study of its biological action, shielding from it and the study of its nature continue to be of high priority in this field of research.

VII. findings

1. A method for the numerical evaluation of intensive
tracks on the surface of various materials. 2. Found the optimal sensitive material for the developed technique - DVD-R discs (polycarbonate).
3. LENR-reactors of two types (Ni-H and plasma electrolysis in water) are sources of tracks of strange radiation.
4. The intensity of the tracks in the zone closer than 20 cm from the reactors is an order or two more than at a greater distance.
5. In addition to tracks from reactors, there are background tracks from unknown sources.
6. The characteristic depth of the tracks is tens to hundreds of nanometers, the characteristic width is units of microns (up to 20 microns). Typical length - units of millimeters.
7. Tracks appear unevenly both in time and in spatial arrangement on samples. Tracks, which are copies of each other, are usually localized in areas of about 1 cm2.

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