KADYMOV, T.G.; ALIYEV, G.K., prof., zasluzhennyy deyatel' nauki; GUSMAN, S.M., prof.; TESLER, Ya.Ye.

On the 70th anniversary of the Mahaparidze No. 3 Clinical Hospital. Azerb. med. zhur. 41 no.1:84-85 Ja '64. (MIRA 17:12)

1. Glavnyy vrach klinicheskoy bol'nitsy No. 3 imeni Mahaparidze, Baku (for Kadymov).

ALIYEV, G.K.; GADZHIYEV, A.A.; TAGIYEV, G.A.

Analysis of some aspects of echinococcosis. Azerb. med. zhur. (MIRA 18:11)
41 no.9:17-25 S '64.

ALIYEV, G.K.; GADZHIYEV, A.A.; LOGINOV, A.A.; KNABENGOF, V.G.; GADZHIYEV, I.M.

Motor chronaxia in premedication for local anesthesia with neuroplegic mixtures. Azerb. med. zhur. 42 no.4:15-20 Ap '65. (MIRA 18:9)

1. Iz kafedry khirurgii (zav.- zasluzhennyy deyatel' nauki prof. G.K. Aliyev) Azerbaydzhanskogo instituta usovershenstvovaniya vrachey imeni Aliyeva (rektor - kand. med. nauk B.M. Agayev).

ALIYEV, G.M.

Effect of chlorine on the heat conductivity of selenium. Izv. AN Azerb.SSR no.9:3-9 S '57. (MLRA 10:9)
(Chlorine) (Selenium) (Heat--Conduction)

ALIYEV, G.M.

20-4-20/51

AUTHORS: Aliyev, G. M., and Abdullayev, G. B.

TITLE: A Note on the Influence of a Chlorine Admixture on the Thermal Conductivity of Selenium (O vliyanii primesi khlora na teploprovodnost' selena).

PERIODICAL: Doklady AN SSSR, 1957, Vol. 116, Nr 4, pp. 598-600 (USSR).

ABSTRACT: The thermal conductivity of semiconductors and its dependence on the chemical composition and on crystal structure was investigated by A. F. Ioffe and his students (reference 1, 2, 3, 4). In the production od selenium rectifiers admixtures of halogenes, in particular chlorine, are used for the purpose of increasing the current passing through the semiconductor. The experiments showed the following results. During the electric formation and the further continued operation of these rectifiers a redistribution of the admixtures takes place, which modifies the electric and thermal characteristics of the selenium layer and of the system as a whole. In the backward direction the voltage applied to the rectifier is localized almost entirely at the anode at the electron-hole transition because of the formation of a great resistance. This causes a temperature gradient along the semiconductor. The authors determined the coefficient of thermal conductivity by a stationary me-

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A Note on the Influence of a Chlorine Admixture on the Thermal Conductivity of Selenium. 20-4-20/51

thod by means of a cylindrical set up, containing a sensitive semi- conductor ring for the removal of lateral heat losses. A diagram illustrates the curves of the modification of heat conductivity of selenium and its dependence on the chlorine content from 2o to 22°C. The different curves are related to vitreous and crystallised se- lenium. The course taken by these curves is independend of the de- gree of crystallization, but depends only on the admixtures. The heat conductivity decreases as far as 0,03% at an increase of the chlorine content, then it increases again and remains constant above a value of 0,5%. A similar dependence of the heat conductivity was found by the author in the case of iodine and bromine admixtures. The dependence of heat conductivity on the degree of crystallization is mainly determined by the conditions of the scattering of the pho- nons with increasing concentration of selenium the concentration of the admixtures is decreased and there with the mean free path of the phonons increases. By this, the frequency of their scattering decreases and the anharmonicity degree of the oscillations and there- fore the heat conductivity increases. The authors here evaluate this influence of the modification of the free path and the numerical values, which were found, are given. On crystallisation the free

Card 2/3

ALIYEV, G. M.: Master Phys-Math Sci (diss) -- "Investigation of the effect of certain additives on the thermal and electrical properties of selenium and germanium". Baku, 1958, published by the Acad Sci Azerb SSR. 14 pp (Min Higher Educ USSR, Azerb State U im S. M. Kirov), 150 copies (KL, No 5, 1959, 142)

69396

SOV/137-59-4-8423

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 4, p 155 (USSR)

24.7700

AUTHORS: Aliyev, G.M., Abdullayev, G.B.

TITLE: The Effect of the Admixture of Chlorine on Electric Properties of Selenium

PERIODICAL: Izv.AS AzerbSSR, Ser. Fiz-tekhn. i khim. n., 1958, Nr 4, pp 23 - 30 (Azerb. résumé)

ABSTRACT: The authors investigated changes in electric conductivity σ and thermo-emf α of Se depending on Cl concentration (0.0035 - 0.5%) and temperature. Crystallization of a smelted Se and $SeCl_4$ mixture was carried out under pressure first at 130°C, then at 200°C (40 minutes each). Cl admixture up to 0.125% raise σ of Se (up to 1,000 times) the maximum is attained at 0.125% an then σ decreases with higher Cl amount. Hole conductivity is preserved. The coefficient α within a range of 25 - 85°C increases with elevated temperature. Electroconductivity in this range of both pure and admixed Se increases with raising temperatures

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69396

SOV/137-59-4-8423

The Effect of the Admixture of Chlorine on Electric Properties of Selenium

according to the exponential law. If the Cl amount increases, dissociation work and coefficient α decrease, and concentration and effective mobility of charge carriers increase. It is concluded that admixtures of Cl cause the formation of additional energy levels in Se, which are arranged at the upper boundary of the filled-up zone.

A.A.

Card 2/2

81505

SOV/137-59-5-10665

24.7600

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 5, p 172 (USSR)

AUTHORS: Aliyev, G.M., Abdulayev, G.B.

TITLE: On the Effect of Chlorine Admixtures on the Heat Conductivity of Selenium

PERIODICAL: Tr. In-ta fiz. i matem. AS AzerbSSR, 1958, Vol 9, pp 20 - 26 (Azerb. résumé)

ABSTRACT: The atuhor used the method of the stationary thermal field to investigate the effect of the admixture of 0.0035 - 1% Cl on the heat conductivity of Se. It was found that the heat conductivity minimum was attained with a 0.03% Cl concentration. After the Cl concentration was as high as 0.5%, the heat conductivity approached a constant value but did not, however, attain its initial value. The course of the heat conductivity curve does qualitatively not depend on the Se recrystallization and is explained by the presence in Se mainly of phonon heat conductivity and by changes in the cross section of phonon scattering depending on the Cl concentration. A.L.

Card 1/1

ABDULLAYEV, G.B.; ALIYEV, G.M.; CHETVERIKOV, N.I.

Influence of Ga and Fe impurities on the thermal conductivity of germanium. Zhur. tekh. fiz. 28 no.11:2368-2371 N '58. (MIRA 12:1)

(Germanium--Thermal properties)

AUTHORS: Aliyev, G. M., Abdullayev, G. B. SOV/20-120-1-19/63

TITLE: The Temperature Dependence of the Thermal Conductivity of Selenium With Small Chlorine Additions (O temperaturnoy zavisimosti teploprovodnosti selena s primes'yu khlora)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 1, pp. 76 - 78 (USSR)

ABSTRACT: The present paper investigates the temperature dependence of the thermal conductivity of crystalline selenium with different additions of chlorine. The samples of different chlorine content were produced of a mixture of selenium tetrachloride and selenium (purity 99,996%). The amount of the chlorine contained in the selenium was determined argentometrically. The coefficient of thermal conductivity was determined by means of the stationary method with a cylindrical apparatus. A diagram shows the temperature dependence of the coefficient of the thermal conductivity upon different chlorine contents. The coefficient of thermal conductivity decreases with rising temperature. Only in the case of pure samples there is a small deviation from the linearity. Another diagram shows the dependence of the

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thermal conductivity on the electric conductivity for samples of pure selenium as well as for samples of different chlorine content. In all samples a linear dependence exists between the electric conductivity and the thermal conductivity. With increasing chlorine content the slope of the straight becomes less. The straights expressing the dependence of the thermal conductivity λ on the electric conductivity σ can be expressed by the equation $\lambda = k\sigma + c$ for samples with and without chlorine additions, where k and c denote constants in all samples. (The corresponding numerical values are given). At all temperatures the thermal conductivity in the case of an increasing electric conductivity first decreases and then increases. The total coefficient of thermal conductivity of a body is, as is known, composed of the coefficients of thermal conductivity dependent on phonons and electrons: $\lambda = \lambda_{electron} + \lambda_{phonon}$. In the samples with and without chlorine additions $\lambda_{electrons}$ is extremely small which is proved by the lack of any influence of the magnetic field on the thermal conductivity. A raise of temperature increases the scattering of the phonons on phonons

The Temperature Dependence of the Thermal Conductivity of Selenium With Small Chlorine Additions SOV/20-120-1-19/63

and therefore reduces the coefficient of thermal conductivity. The deterioration of the Volt-Ampère characteristics of the selenium rectifiers as a consequence of a temperature rise partly is dependent on the decrease of the coefficient of thermal conductivity of selenium and therefore also on the decrease of the thermal scattering. Selenium with an addition of 0,0035% chlorine has its greatest thermal conductivity at 80° (which corresponds to the operational temperature of the selenium rectifiers). There are 4 figures and 13 references, allof which are Soviet.

PRESENTED: November 1, 1957, by A.F.Ioffe, Member, Academy of Sciences, USSR

SUBMITTED: October 11, 1957

1. Selenium--Conductivity 2. Conductors--Temperature factors 3. Selenium--Heat transfer 4. Heat--Conductivity 5. Chlorine --Properties 6. Dry disk rectifiers--Analysis

Card 3/3

ALIYEV, G.M.

PHASE I BOOK EXPLOITATION SOV/4966

Soveshchaniye po poluprovodnikovym materialam. Moscow, 1957

Voprosy metallurgii i fiziki poluprovodnikov; trudy 3-go soveshchaniya. (Problems in the Metallurgy and Physics of Semiconductors; Transactions of the Third Conference) Moscow, Izd-vo AN SSSR, 1959. 129 p. Errata slip inserted. 3,200 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A. A. Baykova. Resp. Ed.: N. Kh. Abrikosov, Doctor of Chemical Sciences; Ed. of Publishing House: P. P. Zolotov.

PURPOSE: This collection is intended for technical and scientific personnel concerned with the investigation and production of semiconductor materials. It may also be used by students in schools of metallurgy.

COVERAGE: The collection contains reports presented at the Third Conference on Semiconductor Materials, held at the Institute of Metallurgy imeni A. A. Baykov, AS USSR, Moscow, in May 1957. The reports deal with problems of obtaining and investigating germanium, silicon, and semiconductor compounds. The collection was first edited by D. A. Petrov, Doctor of Technical Sciences. References accompany most of the reports.

AVAILABLE: Library of Congress

Card 5/5

JP/dfk/os
3/30/61

ALIYEV, G.

24(4) PHASE I BOOK EXPLOITATION SOV/3140

Akademiya nauk Ukrainskoy [SSR]. Institut fiziki

Fotoelektricheskiye i opticheskiye yavleniya v poluprovodnikakh; trudy pervogo vsesoyuznogo soveshchaniya po fotoelektricheskim i opticheskim yavleniyam v poluprovodnikakh, g. Kiyev, 20-26 noyabrya 1957 g (Photoelectric and Optical Phenomena in Semiconductors; Transactions of the First Conference on Photoelectric and Optical Phenomena in Semiconductors...) Kiyev, 1959. 403 p. 4,000 copies printed.

Additional Sponsoring Agency: Akademiya nauk SSSR. Prezidium. Komissiya po poluprovodnikam.

Ed. of Publishing House: I. V. Kisina; Tech. Ed.: A. A. Matveychuk; Resp. Ed.: V. Ye. Lashkarev, Academician, Ukrainian SSR, Academy of Sciences.

PURPOSE: This book is intended for scientists in the field of semiconductor physics, solid state spectroscopy, and semiconductor devices. The collection will be useful to advanced students in universities and institutes of higher technical training specializing in the physics and technical application of semiconductors.

COVERAGE: The collection contains reports and information bulletins (the latter are indicated by asterisks) read at the First All-Union Conference on Optical and Photoelectric Phenomena in Semiconductors. A wide scope of problems in semiconductor physics and technology are considered: photoconductivity, photoelectromotive forces, optical properties, photoelectric cells and photoresistors, the actions of hard and corpuscular radiations, the properties of thin films and complex semiconductor systems, etc. The materials were prepared for publication by E. I. Rashboy, O. V. Snitko, K. B. Tolpygo, A. F. Lubchenko, and M. K. Sheynkman. References and discussion follow each article.

Photoelectric and Optical Phenomena (Cont.) SOV/3140

Photoelectric and Optical Phenomena (Cont.) SOV/3140

68263

SOV/81-59-10-34022

24.7600

Translation from: Referativnyy zhurnal. Khimiya, 1959, Nr 10, p 28 (USSR)

AUTHORS: Aliyev, G.M., Abdullayev, G.B.

TITLE: On the Effect of the Admixture of Chlorine on the Heat Conductivity of Selenium

PERIODICAL: Tr. In-ta fiz. matem. AS AzerbSSR, 1959, Vol 9, pp 20-26 (Azerbaydzhanian summary)

ABSTRACT: The heat conductivity λ of amorphous and crystalline Se and the effect of a Cl admixture on it has been studied. The increase of λ at the transition from amorphous to crystalline Se is connected with the reduction of the quantity of defects in the lattice which are centers of scattering of phonons. The admixture of Cl to a certain percentage increases the efficient cross section of phonon scattering, which leads to the reduction of λ ; at a further increase of the Cl concentration due to recombination of the admixtures and the formation of neutral molecules, λ increases again. The ratio $\lambda_{cr}/\lambda_{am}$ for admixture-free samples is equal to 2, in the case of samples with Cl it is, independently from the Cl content, equal to 3. It is assumed that in the crystallization of Se the admixtures are displaced

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On the Effect of the Admixture of Chlorine on the Heat Conductivity of Selenium

and are concentrated in the intercrystalline interlayer and affect their heat conductivity.

V. Ostroborodova

28016
S/081/61/000/015/005/139
B101/B110

24.7100

AUTHORS: Abdullayev, G. B., Aliyev, M. I., Bashshaliyev, A. A., Aliyev, G.M.

TITLE: Effect of halide impurities on the physical properties of selenium

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 15, 1961, 29-30, abstract 15B196 (Sb. "Vopr. metallurgii i fiz. poluprovodnikov", M., AN SSSR, 1959, 80-88)

TEXT: The authors studied the effect of halide impurities on the crystallization rate, electrical, thermal, and optical properties of Se. X-ray analysis showed that at annealing temperatures from 60 - 80°C iodine impurities accelerate Se crystallization. In the presence of I and Br, Se begins to crystallize at 60°C, while pure Se begins to crystallize only at 80°C. Halide impurities increase the electrical conductivity of Se by several hundred times. The dependence of the hole mobility on the

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B101/B110

Effect of halide impurities on the ...

impurity concentrations shows a maximum. With rising temperature the hole mobility in pure Se and in Se with iodine impurities increases, while their concentration decreases. This phenomenon is explained by structural peculiarities of Se which is a polymer, and by the effect of the intercrystalline amorphous layers acting as potential barriers. On transition from the amorphous to the crystalline modification, thermal conductivity of Se increases from $3.13 \cdot 10^{-3}$ to $7.01 \cdot 10^{-3}$ cal/cm·sec·deg (25°C). In this case specific heat decreases. At 640 mμ the forbidden-band width of the amorphous Se is 1.94 ev, that of crystalline Se (at 680 mμ) is 1.83 ev. [Abstracter's note: Complete translation.]

Card 2/2

ALIYEV, B.D. ; ALIYEV, G.M.

Effect of cadmium impurities on the thermal and electrical conductivity of selenium. Izv.AN Azerb.SSR.Ser.fiz.-mat.i tekh.nauk no.5:85-90 '60. (MIRA 14:4)

(Selenium--Thermal properties)
(Selenium--Electric properties)
(Cadmium)

ALIYEV, G.M.; ALIYEV, B.D.; KERIMOV, I.G.

Temperature dependence of the thermal conductivity of selenium with an admixture of cadmium [in Azerbaijani [with summary in Russian]. Izv. AN Azerb. SSR. Ser. fiz.-mat. i tekh. nauk no.6:99-104 '60. (MIRA 14:8)
(Selenium—Thermal properties)

36796
S/137/62/000/004/058/201
A052/A101

24.7700

AUTHORS: Barkinkhayev, Kh. G., Aliyev, G. M., Kerimov, I. G.

TITLE: The effect of gallium admixture on electric properties of pure selenium

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 4, 1962, 50 - 51, abstract 4G331 ('Izv. AN AzerbSSSR. Ser. fiz.-matem. i tekhn. n.", no. 3, 1961, 63 - 74, Azerbaydzhanian summary)

TEXT: The effect of Ga on electric properties of pure Se was studied as well as the possibility of substituting by gallium the haloid admixtures applied at present in the industry. The Se used had a purity of 99.9996%. Ga was introduced both as GaSe and in the metallic form. When producing Ga and Se samples, a mechanical mixture of Se powder and metallic Ga was charged into ampoules, which were evacuated to the pressure of 10^{-4} mm mercury column and placed in a muffle furnace where the temperature was gradually raised up to 800°C. The exposure was 4 hours and thereafter the mixture was cooled with the furnace. When preparing Se and GaSe samples, the mechanical mixture in evacuated ampoules was heated to 1,100°C. The electric conductivity was measured by a sound method in the tempera-

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A052/A101

The effect of gallium admixture on...

ture range of 20 - 200°C both on pure Se samples and on those with 0.25, 0.5, 1, 2, 3 and 4 weight % Ga. It has been shown that with an increased Ga concentration the electric conductivity increases, reaches maximum, and then drops. At 4% Ga, added in the form of GaSe, Se changes metallic character of conductivity into semiconductor one. The electric conductivity of Se samples with a metallic Ga admixture increases with the temperature. The differential thermoelectromotive force was measured in the temperature range of 20 - 200°C. At indoor temperature the thermoelectromotive force of Se is 914 μv/degree, and it drops rapidly with the increase of temperature. Samples with a Ga admixture have a hole type conductivity. GaSe and metallic Ga admixtures change essentially the course of the temperature dependence of the thermoelectromotive force of pure Se. The thermoelectromotive force of Se with a GaSe and metallic Ga admixture increases essentially with the temperature. The hole mobility in Se with a GaSe admixture increases with the temperature, and in Se with a metallic Ga admixture it decreases up to 70°C and increases with a further increase of the temperature.

B. Turovskiy

[Abstracter's note: Complete translation]

Card 2/2

38360

S/058/62/000/005/085/119
A061/A101

24.7700

AUTHORS: Aliyev, B. D., Aliyev, G. M., Kerimov, I. G.

TITLE: Effect of some metallic impurities on electrical and thermal properties of hexagonal selenium

PERIODICAL: Referativnyy zhurnal, Fizika, no. 5, 1962, 29, abstract 5E231 ("Izv. AN AzerbSSR Ser. fiz.-matem. i tekhn. n.", 1961, no. 4, 37 - 44; Azerb. summary)

TEXT: It is shown that Bi and Cd impurities up to a specific content (0.04% Bi and 0.125% Cd) reduce the thermal conductivity of Se, but raise it if their content is increased further. Bi, Cd, and Ga impurities raise the electrical conductivity of Se. Ga raises it to a higher degree than Bi and Cd. Bi and Cd impurities reduce the thermo-emf of Se, whereas Ga raises it. The thermo-emf of both pure and impurity-containing Se grows with temperature. The sign of the thermo-emf of both pure Se and Se containing Bi, Cd, and Ga impurities, is indicative of the hole mechanism of the carriers.

[Abstracter's note: Complete translation]

Card 1/1

ALIYEV, B.D.; ALIYEV, G.M.; KERIMOV, I.G.

Effect of a gallium admixture and temperature on the thermal conductivity of amorphous and crystalline selenium. Izv. AN Azerb. SSR. Ser.fiz.-ma . i tekh.nauk no.5:39-43 '61. (MIRA 15:2)
(Selenium--Thermal properties) (Gallium)

ALIYEV, G.M.; ASKEROV, Ch.M.; KERIMOV, I.G.

Effect of a sulfur admixture on the electric properties of selenium. Izv. AN Azerb. SSR. Ser.fiz.-mat. i tekh.nauk no.5:45-49 '61. (MIRA 15:2)

(Selenium--Electric properties) (Sulfur)

37082
Z/019/62/019/005/001/001
D006/D102

24.7700

AUTHORS: Aliyev, G.M., Abdullayev, G.B., Bakinkhoyev, Kh.G., et al.

TITLE: Electrical properties of pure selenium

PERIODICAL: Přehled technické a hospodářské literatury. Energetika a elektrotechnika, v. 19, no. 5, 1962, 199, abstract # E 62-26'1. Maruzalar Dokl. 7, no. 7, 1961, 569-573

TEXT: The author starts from the proven fact that the concentration of holes in selenium decreases and mobility increases with increasing temperature. This phenomenon does not conform with the semiconductor theory. The conducted experiments show that this discrepancy is closely related to the chemical purity of selenium. Diagrams show the curves of the dependence of electrical conductivity of Se (99.994%), Se (99.996%) and Se with small admixture of Mg and Si. These curves demonstrate that the decrease of electric conductivity with increasing temperature depends on the degree of purity. The dependence of thermoelectric force on temperature was also verified. The original article contains 4 figures and 16 references. [Abstracter's note: Complete translation].

Card 1/1

ALIYEV, B.D.; ABDULLAYEV, G.B.; ALIYEV, G.M.; KERIMOV, I.G.

Electric properties of selenium with a gallium admixture. Dokl. AN Azerb. SSR 17 no. 3:191-196 '61. (MIRA 14:5)

1. Institut fiziki AN AzerbSSR.
(Selenium—Electric properties)

S/137/62/000/004/059/201
A052/A101

24,7700

AUTHORS: Aliyev, G. M., Abdullayev, G. B., Barkinkhoyev, Kh. G., Kerimov, I. G.

TITLE: Electrical properties of pure selenium

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 4, 1962, 51, abstract 4G332 ("Dokl. AN AzerbSSR", 17, no. 7, 1961, 569 - 574, Azerbaydzhanian summary)

TEXT: Measurements of electric conductivity and thermoelectromotive force of 99.9996% pure Se were carried out. The electric conductivity σ of pure Se decreases with the increase of temperature from indoor to 150°C and then starts increasing. The decrease of σ at temperatures up to 150°C is explained by the prevailing effect of the decreased mobility over the increased concentration of current carriers. The thermoelectromotive force at indoor temperature was 914 μv/degree and it dropped rapidly with the increase of temperature. The thermoelectromotive force was measured by the compensation method. The concentration of current carriers at indoor temperature was $5.7^{9} \cdot 10^{15}$ cm^{-3}. The measurements were compared with the data obtained on 99.994% pure Se. There are 16 references.
[Abstracter's note: Complete translation] A. Gubenko

Card 1/1

33678
S/058/61/000/012/048/083
A058/A101

26.2421

AUTHORS: Aliyev, B. D., Abdullayev, G. B., Aliyev, G. M., Kerimov, G. I.

TITLE: Electric properties of gallium-doped selenium

PERIODICAL: Referativnyy zhurnal, Fizika, no. 12, 1961, 359, abstract 12E481 (Dokl., AN AzerbSSR, 1961, v. 17, no. 13, 191 - 196, Azerb. summary)

TEXT: The effect of gallium-doping on the electric conductivity δ and thermo-emf α of Se was investigated. Doping with up to 0.125 wt % Ga causes σ of Se to increase almost 160 times, after which σ slowly decreases with increasing Ga content. α of specimens with different Ga content was measured in the range 20° - 200°C. The sign of α always points to p-type conductivity. The temperature dependence of hole mobility μ_p for different Ga content is plotted. In specimens containing 0.125 wt % Ga, μ_p at first decreases sharply, then remains constant. In the rest of the specimens, μ_p increases with temperature.

B. Ol'khov

[Abstracter's note: Complete translation]

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Card 1/1

BARKINKHOYEV, Kh.G.; ALIYEV, G.M.

Electric properties of selenium of varying purity in the solid and liquid phases. Izv. AN Azerb. SSR.Ser. fiz.-mat. i tekh. nauk no.3:95-101 '63. (MIRA 16:11)

VELIYEV, M.I.; KERIMOV, I.G.; ALIYEV, G.M.; ALIYEV, M.I.

Effect of crystallization on the heat conductivity of selenium. Izv. AN Azerb. SSR. Ser. fiz.-mat. i tekh. nauk no.4:33-36 '63. (MIRA 16:12)

ACCESSION NR: AP4027708 S/0233/63/000/006/0073/0078

AUTHOR: Barkinkhoyev, Kh. G.; Askerov, Ch. M.; Aliyev, G. M.

TITLE: The effect of a mercury admixture on the electric properties of selenium

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiz.-matem. i tekhn. nauk, no. 6, 1963, 73-78

TOPIC TAGS: mercury, mercury vapor, selenium, electric conductivity, diffusion factor, component suspension, molybdenum ampule, thermoelectromotive forces donor level, acceptor level

ABSTRACT: The investigation into the effect of mercury impurities on the electric properties of selenium was prompted by the contradictory opinions on this subject published in literature. The samples involved in the test were molybdenum ampules with selenium and mercury. Following a special treatment, the samples were crystallized at 210C for 25 hours. The electric conductivity and thermoelectromotive force were then measured by the compensation method, and the graphs were plotted on the basis of the mean values of several measure-

Card 1/2

ACCESSION NR: AP4027708

ments. The same samples were used for measuring the thermoelectromotive force in relation to copper within an 8-10 degree gradient and 20-200 C temperature range. The experimental data reveal that the small concentrations of mercury atoms in the selenium tend to reduce its electrical conductivity. This can be explained by the assumption that the mercury atoms in the selenium produce donor levels which increase with increasing impurities, intensifying their compensation of the selenium acceptor levels. Such an effect of the impurities prior to the full compensation of the selenium acceptor levels, should lead to a reduced electric conductivity. The increasing temperature relationship of the concentration and the reduced mobility of the current carrier in selenium are natural from the point of view of the band theory. All the data published in literature indicate that the mobility increases and the concentration of the current carriers in selenium decreases with temperature. But this problem, on the whole, is still not very clear. Orig. art. has: 6 figures

ASSOCIATION: AN AzerbSSR

SUBMITTED: 00 DATE ACQ: 17Apr64 ENCL: 00

SUB CODE: PH, CH NO REF SOV: 004 OTHER: 006

Card 2/2

ALIYEV, B.D.; ABDULLAYEV, G.B.; ALIYEV, G.M.

Effect of bismuth impurities on the heat conductivity and self-diffusion of selenium. Trudy Inst. fiz. AN Azerb. SSR 11:5-10 '63.
(MIRA 16:4)

(Selenium--Thermal properties) (Bismuth)

ALIYEV, B.D. ALIYEV, G.M.

Effect of a cadmium impurity on the thermal and electric conductivity of selenium. Trudy Inst. fiz. AN Azerb. SSR 11:19-24 '63.
(MIRA 16:4)

(Selenium--Thermal properties) (Selenium--Electric properties)

ABDULLAYEV, G.B.; ALIYEV, G.M.; BASHSHALIYEV, A.A.; KERIMOV, I.G.

Heat conductivity of some compounds of the type $A^{III}B^{V}$. Trudy Inst. fiz. AN Azerb. SSR 11:46-51 '63. (MIRA 16:4)
(Semiconductors—Thermal properties)

ABDULLAYEV, G.B.; ALIYEV, G.M.; BARKINKHOYEV, Kh.G.

Thermal conductivity of selenium. Fiz. tver. tela 5 no.12:3614-3615 D '63. (MIRA 17:2)

1. Institut fiziki AN AzerbSSR, Baku.

ACCESSION NR: AP4005130 S/0249/63/019/008/0009/0013

AUTHORS: Abdullayev, G. B.; Aliyev, G. M.; Barkinkhoyev, Kh. G.

TITLE: Effect of gallium impurities on the thermal conductivity of hexagonal selenium

SOURCE: AN AzerbSSR. Doklady*, v. 19, no. 8, 1963, 9-13

TOPIC TAGS: selenium thermal conductivity, selenium, thermal conductivity, hexagonal selenium, gallium impurity effect, gallium impurity, gallium, amorphous selenium, metallic impurity, selenium valve, Ioffe formula, phonon mechanism, absorption coefficient, crystalline selenium, nonmetallic impurity, crystal lattice, metallic gallium impurity, selenium doping, phonon scattering

ABSTRACT: The influence of metallic gallium admixtures on the heat conductivity λ of crystalline selenium in the temperature interval of 85-450K has been studied. Cylindrical crystal agglomerates of pure selenium with 0, 0.25, 0.50, 1.0, 2.0, 3.0 and 4.0 wt % were tested. Their diameters were 10-12 mm and their lengths 10-13 mm. Tests were conducted under static conditions. To avoid radiation heat losses, lateral surfaces of the specimens were coated with india ink and carbon black. It

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ACCESSION NR: AP4005130

was found that at 299K λ reached its maximum for the 1% admixture. A study of temperature-λ relations for 3 samples brought out the existence of minima in the 300-330 K range. The electron component of λ was estimated to be on the order of 10^{-8}-10^{-10} cal/cm sec degree. The phonon theory of heat conductivity indicates that for the Debye temperatures and above, λ is inversely proportional to T:

$$\lambda = a\frac{1}{T}\frac{кал}{см \cdot сек \cdot град} \qquad (1)$$

The present experiments confirmed this theory for T between the temperatures of liquid nitrogen and room temperature (with coefficient a varying from 0.75 to 0.98 for different samples). At higher temperatures (350K) an increase in λ, reaching 25-30% at 409K, was observed. This increase is attributed to the photon mechanism and to heat being conducted by electromagnetic readiation. The authors thank O. G. Kerimov, director of the heat laboratory, for his interest and valuable suggestions. Orig. art. has: 3 graphs, 1 table, and 3 equations.

ASSOCIATION: Institut fiziki AN AzerbSSR (Institute of Physics AN AzerbSSR)

SUBMITTED: 23May63 DATE ACQ: 20Jan64 ENCL: 00

Card 2/3

ACCESSION NR: AP4005130

SUB CODE: PH NO REF SOV: 015 OTHER: 004

Card 3/3

ASKEROV, Ch.M.; ALIYEV, G.M.; AKHUNDOVA, E.G.

Heat conductivity, density, and microhardness of the system selenium-sulphur. Izv. AN Azerb. SSR. Ser. fiz.-tekh. i mat. nauk no.1:83-89 '64. (MIRA 17:9)

L 7012-65 EWT(l)/EPA(w)-2/EWT(m)/EPF(n)-2/EWG(v)/EPR/EWP(q)/EWP(t)/EWA(l)
Pe-5/Pa-4/Pi-10/Pa-4 ESD(gs) RDW/AFW/JD

ACCESSION NR: AP4044630 S/0233/64/000/0 2/0097/0100

AUTHORS: Aliyev, G. M.; Veliyev, M. I.

TITLE: Effect of heat treatment on the thermal conduct vity of selenium

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnich skikh i matematicheskikh nauk, no. 2, 1964, 97-100

TOPIC TAGS: selenium, thermal conductivity, heat treatment

ABSTRACT: The selenium investigated was 99.9999% pure and was made amorphous by cooling selenium molten in vacuum (10^{-4} mm Hg). Two samples were made and their thermal conductivities measured from 77 to 300K. They were then annealed as follows: one at 37), 423, 473, 483, 488 and 490K, and the other at 453K for 1, 4, 10, 0, 80, and 360 hours. Plots of λ against T (thermal conductivity against the temperature) were plotted after each annealing. All the measurements

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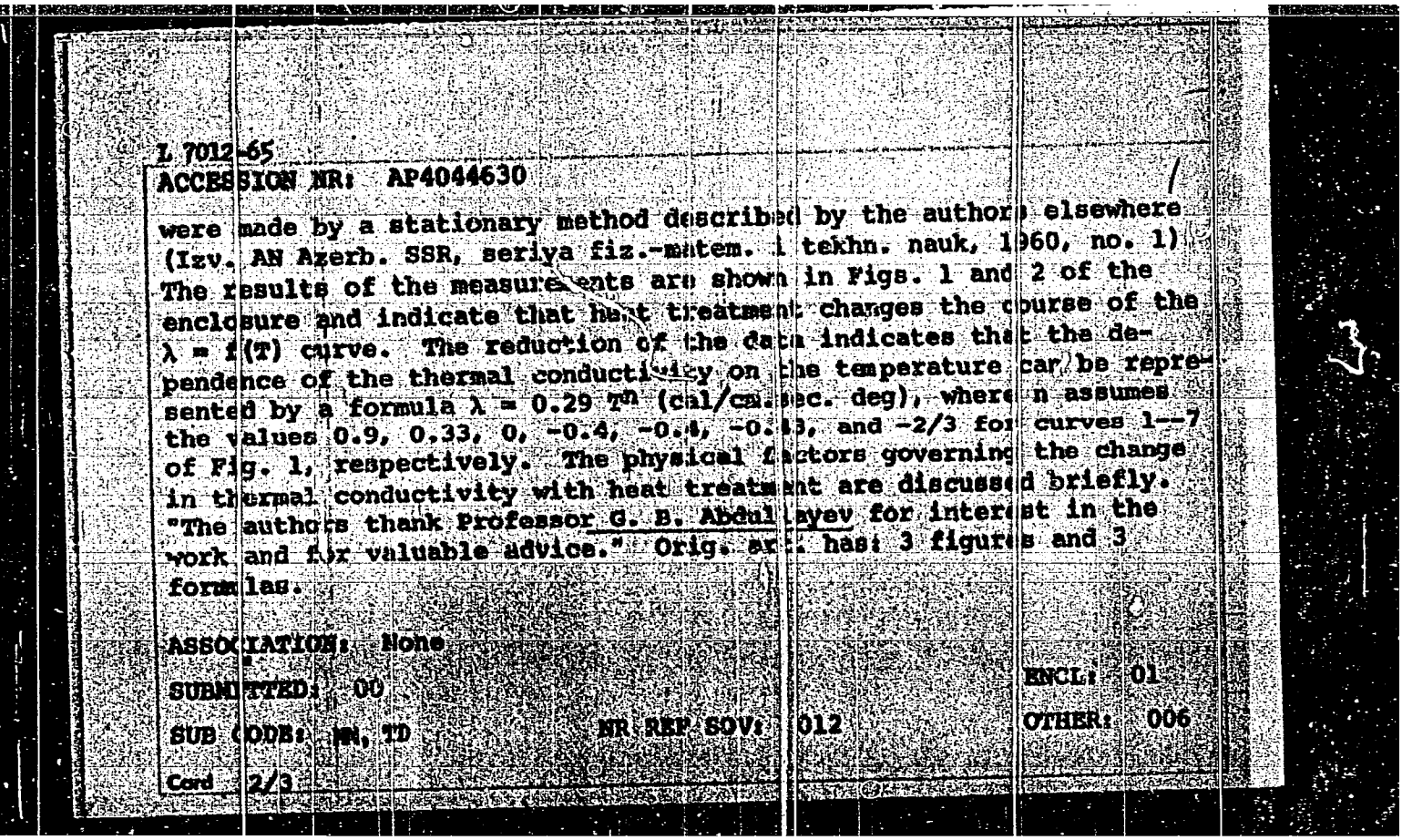

L 7012-65
ACCESSION NR: AP4044630

were made by a stationary method described by the author elsewhere (Izv. AN Azerb. SSR, seriya fiz.-matem. i tekhn. nauk, 1960, no. 1). The results of the measurements are shown in Figs. 1 and 2 of the enclosure and indicate that heat treatment changes the course of the $\lambda = f(T)$ curve. The reduction of the data indicates that the dependence of the thermal conductivity on the temperature can be represented by a formula $\lambda = 0.29\ T^n$ (cal/cm. sec. deg), where n assumes the values 0.9, 0.33, 0, -0.4, -0.4, -0.5, and -2/3 for curves 1--7 of Fig. 1, respectively. The physical factors governing the change in thermal conductivity with heat treatment are discussed briefly. "The authors thank Professor G. B. Abdullayev for interest in the work and for valuable advice." Orig. art. has: 3 figures and 3 formulas.

ASSOCIATION: None

SUBMITTED: 00 ENCL: 01

SUB CODE: MM, TD NR REF SOV: 012 OTHER: 006

Card 2/3

L 7012-65
ACCESSION NR: AP4044630

ENCLOSURE: 01

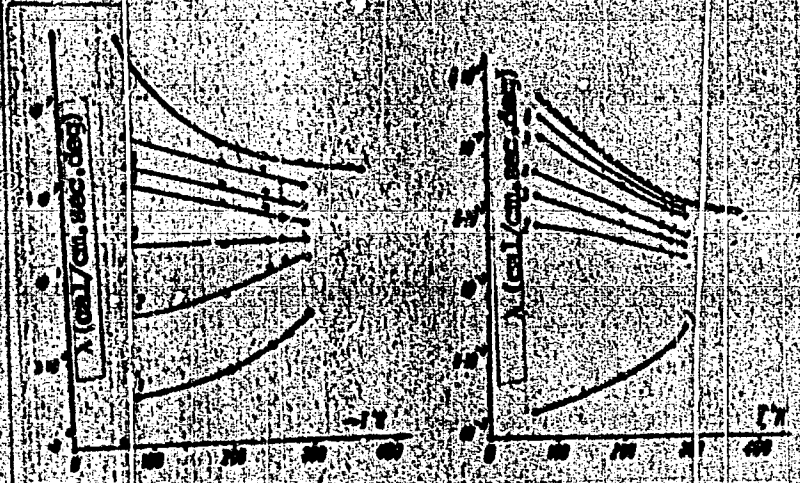

Fig. 1 (left)
Thermal conductivity of selenium vs. temperature. Annealing for one hour at various temperatures.

Fig. 2 (right)
Thermal conductivity of selenium vs. temperature. Annealing at one temperature and different time intervals

Card 3/3

L 6981-65 EWT(1)/EPA(s)-2/EWT(v)/EPF(n)-2/EWG(v)/EPR/EWP(q)/EWP(b)/EWA(1)
Pe-5/Pa-4/Pt-10/Pu-4 ESD(gs)/RAEM(t) RDW/JD/AWW
ACCESSION NR: AP4044631 S/0233/64/000/002/0109/0114

AUTHORS: Abdinov, D. Sh.; Aliyev, G. M.

TITLE: On the thermal conductivity of selenium

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 2, 1964, 109-114

TOPIC TAGS: selenium, thermal conductivity, glass property, temperature dependence, ordered structure

ABSTRACT: The authors first point out that the changes in the thermal conductivity occurring in glass-like materials in the softening interval, including glass-like selenium, are debatable and that there is no direct evidence to confirm the presence of an anomalous variation of the thermal conductivity of glasslike selenium. They have consequently investigated the thermal conductivity of glass-like and crystalline selenium over a wide range of tempera-

Card 1/4

tures, from 77 to 340K for amorphous samples, including the softening region, and up to 525K for crystalline samples, including the melting region. The selenium was 99.9999% pure, and the thermal conductivity was measured by two different methods. The temperature dependence of the thermal conductivity of amorphous and crystalline selenium is shown on Fig. 1 of the enclosure. Up to and beyond the vitrification temperature (T_g = 30.7C) the thermal conductivity of amorphous selenium exhibits a linear growth, similar to that exhibited by various glasses. Heat treatment increases the thermal conductivity and changes its temperature variation, with the anomalous change in thermal conductivity at the point T_g completely disappearing with further heat treatment, obviously owing to partial crystallization of the sample. The physical factors involved in the test results are discussed. In particular, the effects due to the ordering of the atomic chains in the amorphous selenium by heat treatment and the presence of two thermal conductivity mechanisms (photon and phonon) are pointed out. Orig. art. has: 1 figure and

L 6981-65
ACCESSION NR: AP4044631

2 formulas.

ASSOCIATION: None

SUBMITTED: 00 ENCL: 01

SUB CODE: MM, TD NR REF GOV: 018 OTHER: 004

Card 3/4

L 6981-65
ACCESSION NR: AP4044631

ENCLOSURE: 01

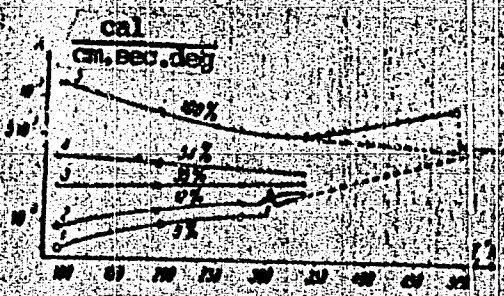

Fig. 1. Thermal conductivity of selenium vs. temperature

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L 20246-65 EWT(m)/EPF(c)/EPF(n)-2/EPR/T/EWP(t)/EWP(b) Pr-4/Ps-4/
Pu-4 IJP(c) RDW/JD
ACCESSION NR: AP5001563 S/0233/64/000/004/0079/0081

AUTHOR: Aliyev, G. M.; Larionkina, L. S.; Dzhalilov, M. A.

TITLE: Growing of selenium single crystals

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 4, 1964, 79-81

TOPIC TAGS: crystal growing, selenium crystal, selenium single crystal, selenium crystal growing, selenium single crystal growing

ABSTRACT: The production of selenium single crystals from vapor in vacuum and in argon and helium is described. Three molybdenum glass tubes 50 cm high and 3.5 cm in diameter were filled with 99.99999-percent-pure powdered selenium to a level 6 cm from the bottom. The tubes were then evacuated down to about 10^{-3} mm Hg, after which two of them were filled respectively with argon and helium up to a pressure of 1 atm. All three tubes were then warmed to 260C and kept at that temperature for 8 days. The heat was supplied by a coil which enclosed the lower half of the tube and extended downwards for some length. Needle-shaped crystals formed on the inner surface of the tubes on

Card 1/2

L 20246-65
ACCESSION NR: AP5001561

their removal from the heating coils. The glass walls above the crystallization area were covered with a red deposit in the case of argon and helium, and with a grey deposit in vacuum. The crystals in vacuum had a cactuslike arrangement, while solid single needles 0.5 to 1.5 cm long formed in the gas media. The longest needles were those grown in helium. Orig. art. has: 3 figures.

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: S

NO REF SOV: 002 OTHER: 003 ATD PRESS: 4163

Card 2/2

L 23594-65 EWT(m)/EWP(t)/EWP(b) IJP(c) RDW/JI

ACCESSION NR: AP5001567 S/0233/64/000/004/0101/0108

AUTHOR: Mekhtiyeva, S. I.; Aliyev, G. M.; Abdinov, D. Sh.

TITLE: New properties of high-purity selenium

SOURCE: AN AzerbSSR, Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 4, 1964, 101-108

TOPIC TAGS: selenium, high purity selenium, ultra pure selenium, alloyed selenium, antimony selenium alloy, cadmium selenium alloy, thallium selenium alloy, sodium selenium alloy, liquid selenium, electric property

ABSTRACT: An experimental investigation has been made of the electric conductivity, thermal emf, and thermal conductivity of crystalline and liquid selenium, (B-4 and B-5) of 99.9999 and 99.99999% purity, respectively, with Sb, Cd, Tl, or Na. These metals are introduced into selenium to compensate for the effect of oxygen, which imparts hole-type conductivity to selenium. The investigation of the changes in the electric properties at the melting point may contribute to the better knowledge of the bonding and structure in the solid and liquid

Card 1/3

phases. The plotted data on such changes caused by increasing the amount of Sb or Cd indicate that minima occur in the curves at 0.5% of the added metal. This phenomenon is explained by the compensating effect of metal on hole concentration; upon further increase of the metal content, additional energy levels are formed, and the conductivity is increased again. The plot showing the effect of metal addition on the temperature dependence of conductivity displays a sharp drop at the melting point, followed by an increase with the temperature rise in the liquid phase. The average values of the activation energy, computed from the curve slopes for the liquid phase, are tabulated. The thermal emf of Sb-alloyed selenium drops to zero at the melting point and then changes sign, indicating a change in the conductivity type to the electronic conductivity; the conductivity increases with temperature. It is noted that the addition of even less than 0.5% Cd changes the conductivity type of selenium even at room temperature and produces a strong increase in thermal emf in the liquid phase. Thus, the addition of Cd produces n-type selenium, the investigation of which is of great interest and may help to obtain p-n junctions in selenium. Similar effects were obtained

L 23594-65
ACCESSION NR: AP5001567

on introduction of Tl or Na, with a smaller drop of electric conductivity at the melting point, because the electric conductivity of Tl- or Na-doped selenium decreases by several orders of magnitude in the solid phase. It is assumed that the metals which compensate for the effect of oxygen form neutral molecules which are the scattering centers for phonons and carriers. The authors state that the addition of Sb, Cd, Tl, and Na to pure selenium produces the same effect as the removal of oxygen. Orig. art. has: 6 figures and 1 table. [BN]

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: IC, EM

NO REF SOV: 008 OTHER: 006 ATD PRESS: 3171

Card 3/3

ACCESSION NR: AP4028423 S/0181/64/006/004/1018/1022

AUTHORS: Abdullayev, G. B.; Aliyev, G. M.; Barkinkhoyev, Kh. G.; Askerov, Ch. M.; Larionkina, L. S.

TITLE: Electrical properties of crystalline and liquid selenium after deoxygenation

SOURCE: Fizika tverdogo tela, v. 6, no. 4, 1964, 1018-1022

TOPIC TAGS: electric conductivity, selenium, deoxygenation, thermoelectromotive force, solid liquid study

ABSTRACT: The authors measured the electrical conductivity and the thermoelectromotive force of three samples of Se in the temperature interval 293-773K. The samples were characterized by the following impurity concentrations: 10^{-3}%, 10^{-4}%, and 10^{-5}% for the three samples, respectively. Measurements were made on all three samples before deoxygenation (ordinary Se) and on samples 1 and 3 after deoxygenation. Different jumps in conductivity were observed during fusion of all three samples of ordinary Se. The activation energy of electrical conductivity was found to be 2.05 ev for liquid Se of this type. In the solid phase, the thermoelectromotive force of sample 1 ordinary Se declined with increase in temperature. During

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ACCESSION NR: AP4028423

fusion the sign changed to negative, and in the liquid phase it increased in absolute value. The thermoelectromotive force of samples 2 and 3 ordinary Se in the crystalline state increased with rise in temperature. During fusion it fell sharply (to zero), did not change sign, and increased again in the liquid state. After deoxygenation, the conductivity at room temperature declined approximately by a factor of 100. No jumps were observed. The activation energy of the conductivity in such liquid Se became 0.6 ev. The thermoelectromotive force of samples 1 and 3 in the liquid state indicates n-type conductivity, increasing in absolute value. In crystalline Se of sample 3, no thermoelectromotive force was observed. It was observed in sample 1, but the value was small and corresponded to hole conductivity. "The authors express their thanks to Professor A. R. Regel' for his interest in the work and for his valuable advice." Orig. art. has: 1 figure.

ASSOCIATION: Institut fiziki AN Azerb. SSR, Baku (Institute of Physics, AN Azerb. SSR)

SUBMITTED: 18Sep63 ENCL: 00

SUB CODE: NO REF SOV: 004 OTHER: 011

Card 2/2

ACCESSION NR: AP4039227 S/0249/64/020/002/0027/0031

AUTHORS: Abdinov, D. Sh.; Abdullayev, G. B.; Aliyev, G. M.

TITLE: The effect of antimony admixture on density, heat conductivity, and microhardness of selenium

SOURCE: AN AzerbSSR. Doklady*, v. 20, no. 2, 1964, 27-31

TOPIC TAGS: antimony, selenium, recrystallization, selenium heat treatment

ABSTRACT: The effect of antimony admixtures on the physical properties of selenium was studied. The samples consisted of antimony and selenium powders mixed in various proportions. These powders were poured into quartz ampules which were evacuated to 10^{-4} mm Hg and sealed. In this state the samples were heated in an oven at 850C for 8 hours and cooled to room temperature. At this stage the samples were amorphous. The measurements of their heat conductivity and density were made before they were replaced in the ampules and allowed to crystallize at 90, 130, and 180C for one hour and at 210C for 60 hours. After each crystallization period the relation between the physical properties of every sample and its antimony content was studied. The variation of the heat conductivity coefficient of selenium with

Card 1/4

ACCESSION NR: AP4039227

respect to antimony concentration at 20-22C is shown in Fig. 1 of the Enclosures, where the conductivity is seen to increase during the transition from the amorphous to the crystalline state. It decreased with the increase in antimony content to 0.125%, beyond which point it started rising. This behavior was explained by the hypothesis of V. N. Lange and A. R. Regel' (FTT, v. 1, no. 4, 1959) which states that small quantities of antimony distort the crystalline lattice of selenium, while larger amounts of antimony have the opposite effect. The variation in the microhardness, thermal conductivity, and density of crystalline selenium with respect to the antimony content is shown in Fig. 2 of the Enclosures. The microhardness minimum also occurred at 0.125% antimony content. In order to check the accuracy of the experimental results, the variation of selenium properties was calculated according to the formula derived by A. V. Ioffe and A. F. Ioffe ("DAN SSSR", 1954, v. 98, No. 5). The theoretical and experimental data correlated closely. Orig. art. has: 1 table, 2 figures, and 3 formulas.

ASSOCIATION: Institut fiziki (Institute of Physics)

SUBMITTED: 19Jul63 DATE ACQ: 05Jun64 ENCL: 02

SUB CODE: SS, GC NO REF SOV: 010 OTHER: 002

Card 2/4

ACCESSION NR: AP4039227

ENCLOSURE: 01

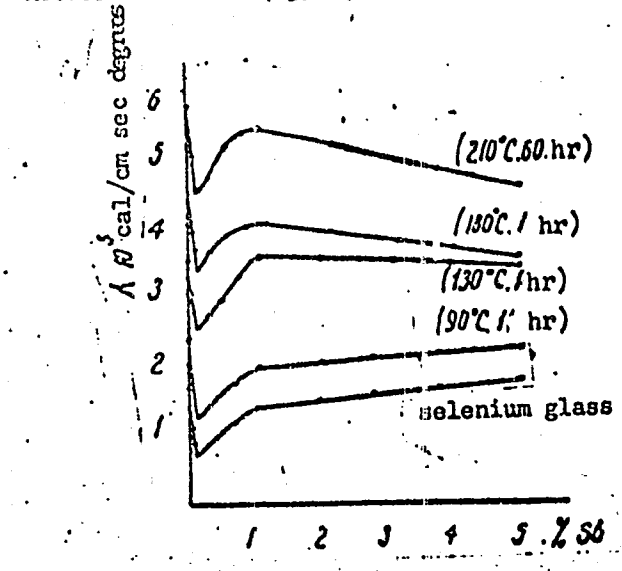


Fig. 1. Relation between heat conductivity of selenium and the antimony content.

Card 3/4

ACCESSION NR: AP4039227

ENCLOSURE: 02

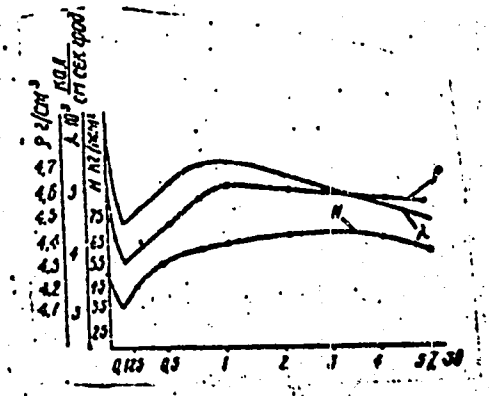


Fig. 2. Relation of microhardness (H), heat conductivity (λ), and density (ρ) of selenium to the antimony

Card 4/4

L 32850-65 EWT(m)/EWP( )/EWP(b) IJP(c) RM/JD

ACCESSION NR: AP5004757 S/0249/64/020/01 /0013/0016

AUTHORS: Abdullayev, G. B.; Ibragimov, N. I.; Mamedov, S . V.; Dzhuvarly, T. Ch.; A iyev, G. M.

TITLE: Paramagnetic resonance in selenium

SOURCE: AN AzerbSSR Doklady, v. 20, no. 10, 1964, 13-1

TOPIC TAGS: selenium, electron paramagnetic resonance, intensity, crystalline selenium, amorphous selenium

ABSTRACT: The author s point out that the main phenomena observed in selenium have not ye been fully explain d, especially the nature of the hole conducti ity, the carrier mo ility, the cryst allization process, and the sta es of the impurities in the selenium and their influence on its pro erties. They conse uently investig ted the EPR absorption in seleni m, about which no published data ar available. The selenium investi ated was 99.9999 and 9.99999% pure . Ampoules

Card 1/3

of molybdenum glass and quartz were used. The measurements were made with a standard setup with a transmission type resonator and double modulation of the magnetic field. The operating frequency was 9302 Mc. The spectrum was recorded with an automatic potentiometer. The standards were DPPH and Mn^{+2} in ZnS. The EPR absorption spectrum was taken at 290 and 77K. A value of 2.0038 ± 0.0005 was obtained for the g-factor, which differed little from the g-factor of the free electron. The line width was found to be 5.0 ± 0.5 Oe. The resonance line width does not increase at liquid nitrogen temperature, but the intensity merely triples. The intensity of the pure selenium was much higher than that of lower purity, and in the latter no paramagnetic absorption was observed at all. The EPR signal had approximately the same intensity in amorphous and crystalline selenium. Since the conductivity of the crystalline selenium is 10^6 times larger than that of the amorphous selenium, it is assumed that the mobility of the intrinsic carriers in the crystalline selenium should be approximately 10^5 times larger than in amorphous.

L 32850-65
ACCESSION NR: AP5004757

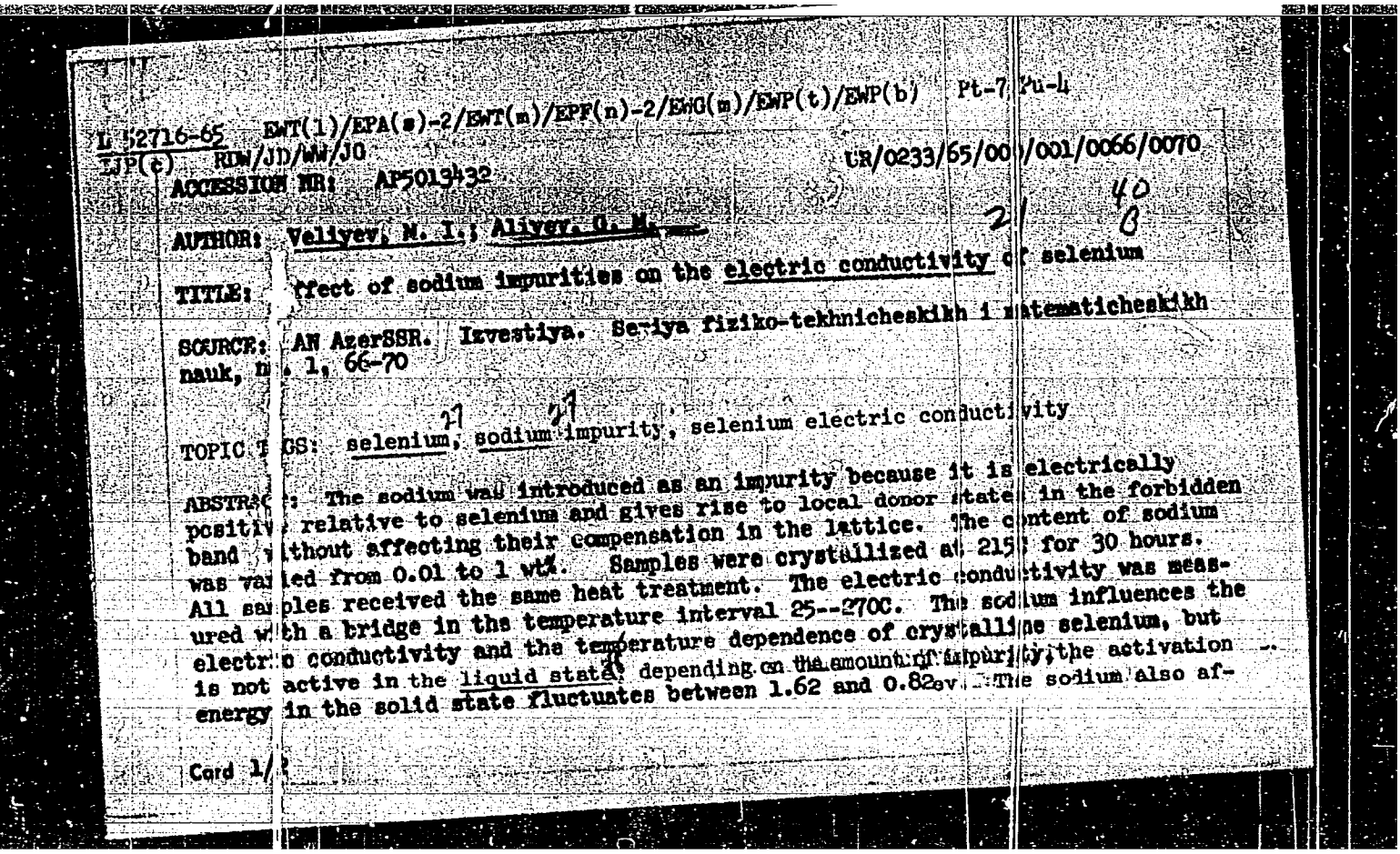
but no experimental data are available to confirm this assumption. The results also indicate that the presence of oxygen does not seem to affect the EPR signal intensity. Orig. art. has: 1 figure.

ASSOCIATION: Institut fiziki AN AzerbSSR (Institute of Physics AN AzerbSSR)

SUBMITTED: 16Jul64 ENCL: 00 SUB CODE: NP, GS

NR REF SOV: 001 OTHER: 005

Card 3/3



L 52716-65 EWT(1)/EPA(s)-2/EWT(m)/EPF(n)-2/EWG(m)/EWP(t)/EWP(b) Pt-7 Pu-4
EJP(c) RDW/JD/WW/JG UR/0233/65/000/001/0066/0070
ACCESSION NR: AP5013432 21 40
AUTHOR: Veliyev, M. I.; Aliyev, G. M. 8
TITLE: Effect of sodium impurities on the electric conductivity of selenium
SOURCE: AN AzerSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 1, 66-70
TOPIC TAGS: selenium, sodium impurity, selenium electric conductivity
ABSTRACT: The sodium was introduced as an impurity because it is electrically positive relative to selenium and gives rise to local donor states in the forbidden band without affecting their compensation in the lattice. The content of sodium was varied from 0.01 to 1 wt%. Samples were crystallized at 215° for 30 hours. All samples received the same heat treatment. The electric conductivity was measured with a bridge in the temperature interval 25--270C. The sodium influences the electric conductivity and the temperature dependence of crystalline selenium, but is not active in the liquid state, depending on the amount of impurity, the activation energy in the solid state fluctuates between 1.62 and 0.82ev. The sodium also af-
Card 1/

L 52716-65
ACCESSION NR: AP5013432 O

fects the melting point of selenium. The temperature dependence of the conductivity for the region of intrinsic conductivity obeys the empirical equation log σ = = B - A/T, where A = -2.1, B = 1930 Å (for 0.01% Na), and T is the temperature. The results indicate that the sodium produces donor levels in the selenium and decreases the electric conductivity and thermal emf by approximately three orders of magnitude, thus producing the same effect as removal of oxygen. When the sodium is introduced into the selenium, intrinsic conductivity appears in the solid state, and the jump in the electric conductivity at the melting point disappears (at 0.01% Na). This indicates that the short-range order, the number and location of the neighbors, and the carrier density remain the same during melting, so that there is no principal difference between the electric properties of solid and liquid selenium. Orig. art. has: 2 figures and 1 formula. [02]

ASSOCIATION: none

SUBMITTED: 17Feb64 ENCL: 00 SUB CODE: SS, EM

NO REF SOV: 018 OTHER: 004 ATD PRESS: 4012

Card 2/2

ALIYEV, G.M.; LARIONKINA, L.S.; DZHALILOV, N.Z.

Production of selenium single crystals. Izv. AN Azerb.SSR.Ser. fiz.-tekh. i mat. nauk no.4:79-81 '64. (MIRA 18:3)

MEKHTIYEVA, S.I.; ALIYEV, G.M.; ABDINOV, D.Sh.

Newly detected properties of selenium of high purity. Izv. AN Azerb. SSR. Ser. fiz.-tekh. i mat. nauk no.4:101-108 '64. (MIRA 18:3)

L 3537-66 EPA(s)-2/EWT(m)/EPF(c)/ETC/EPF(n)-2/EWG(m)/EWP(t)/EWP(b) IJP(c)
ACCESSION NR: AP5015450 RDW/JD/WW/JG UR/0249/65/021/003/0018/0021

AUTHORS: Abdullayev, G. B.; Abdinov, D. Sh.; Aliyev, G. M.

TITLE: Effect of oxygen on transport phenomena in selenium of high purity

SOURCE: AN AzerbSSR. Doklady, v. 21, no. 3, 1965, 18-21

TOPIC TAGS: selenium, selenium rectifier, thermal conductivity, electric conductivity, thermal emf, Hall effect, carrier density, Hall mobility

ABSTRACT: The authors report results of investigations of the influence of antimony impurity, which effectively compensates the acceptor action of oxygen, on the electric properties of crystalline and liquid selenium and on the thermal conductivity of crystalline selenium of purity 99.9999 per cent before and after deoxidation and after oxidation. The deoxidation was by the method of P. T. Kozyrev (FTT v. 1, 113, 1959). The procedure for measuring electric conductivity and the thermal conductivity as functions of the impurities and of the

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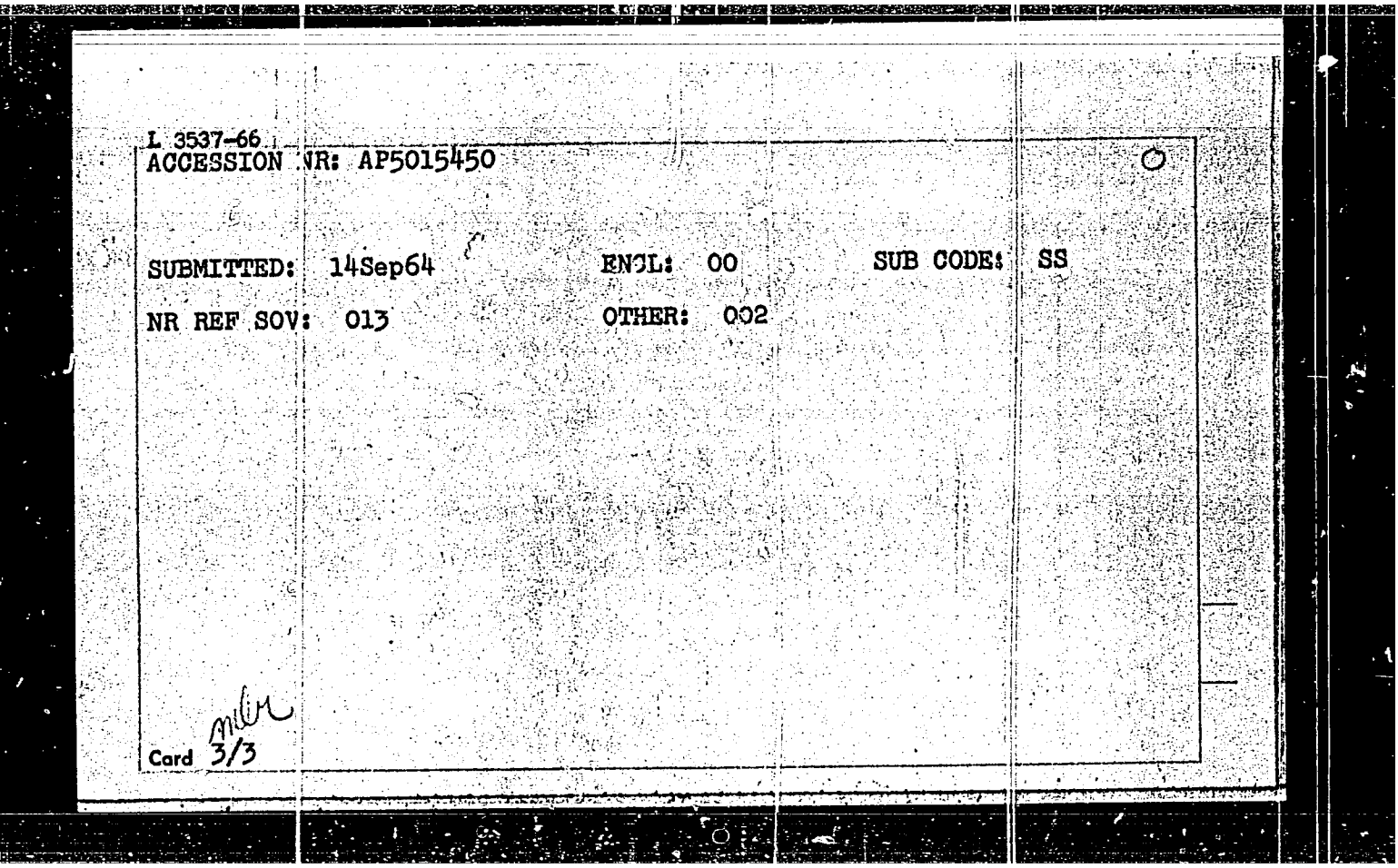
L 3537-66
ACCESSION NR: AP5015450 2

temperature was described earlier (FTT v. 4, 1018, 1964 and elsewhere). The Hall effect was measured with direct current by a compensation method in a magnetic field of 20,000 Oe. The article includes a table of the dependence of the electric conductivity, the thermal conductivity, the Hall density, and the Hall mobility prior to deoxidation, and also of the electric conductivity and thermal conductivity after deoxidation, as functions of the antimony content, and plots of the temperature dependence of the electric conductivity before and after deoxidation. The results show that the antimony has different effects on the electric and thermal conductivities before and after deoxidation, and varies with the antimony content. The jump in the conductivity occurring at the melting point also depends on the oxygen content. The results have a direct bearing on the fact that various mechanical properties of selenium rectifiers and photocells are governed principally by their oxygen content. Orig. art. has: 2 figures and 1 table.

ASSOCIATION: Institut fiziki AN AzerbSSR (Institute of Physics, AN AzerbSSR) 55

Card 2/3



L 3537-66
ACCESSION NR: AP5015450

SUBMITTED: 14Sep64 ENCL: 00 SUB CODE: SS

NR REF SOV: 013 OTHER: 002

Card 3/3

VELIYEV, M.I.; ALIYEV, G.M.

Effect of sodium admixtures on the electroconductivity of selenium. Izv. AN Azerb. SSR. Ser.fiz.-tekh. i mat. nauk no.1:66-70 '65. (MIRA 18:6)

L 32952-66 EWT(m)/EWP(t)/ETI IJP(c) RDW/WW/JD/JG

ACC NR: AP6017056 (N) SOURCE CODE: UR/0233/65/000/004/0074/0079

AUTHOR: Abdinov, D. Sh.; Aliyev, G. M.

ORG: none

TITLE: Effect of oxygen additions on the electrical properties of selenium

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 4, 1965, 74-79

TOPIC TAGS: selenium, thermal emf, Hall effect, activation energy, Hall mobility, current carrier, electric property

ABSTRACT: Measurements were made of the effects of Sb additions on the electrical conductivity σ of Se before and after deoxygenation, after oxygenation, as well as of the temperature function of the Hall effect in the solid and liquid states. The work was carried out to fill a gap in the literature. The antimony was added as Sb and Sb_2Se_3 in amounts of 0.05, 0.1, 0.125, 0.25, 0.5, 0.75, 1, 2, and 5 wt %. For ordinary Se (prior to deoxygenation), the σ decreases with increasing content of Sb and at 0.5% it reaches a minimum; with further addition of Sb, it increases. The σ was found to be the same for Sb_2Se_3. At 20-220°C, the σ practically does not change. At the melting point, the σ drops abruptly. After melting, (starting at 240°C), it rises exponentially with temperature. Activation energies ΔE, calculated from the slope of the lg vs

Card 1/2

L 32952-66

ACC NR: AP6017056

4

vs $1/T$ curve, are affected little by small concentrations; starting at 1% Sb, ΔE gradually increases and at 5%, reaches 0.52 ev. In melting pure Se, the concentration of the current carriers decreases from $2.27 \cdot 10^{14}$ at 2.6°C to $3.20 \cdot 10^{13}$ cm^{-3} at 350°C and it continues to decrease with further heating. Measurements of magnetic susceptibility in the solid and liquid states indicate a decrease concentration of holes during melting. Temperature function of the concentration of the current carriers, determined from the Hall effect and the thermal emf, is about the same. At room temperature, the Hall mobility in pure Se is equal to 10.45 $cm^2/v \cdot sec$ and is in good agreement with literature data. The mobility of holes in pure Se grows insignificantly with temperature in the solid state and in melting it drops abruptly, but in the liquid state, it grows exponentially with temperature. In conclusion the authors thank Professor G. B. Abdullayev for supervising the work and Ya. N. Nasirov, R. Kh. Nani and V. B. Antonov for assistance in measuring the Hall effect. Orig. art. has: 2 tables, 3 figures.

SUB CODE: 20/ SUBM DATE: 06Jun64/ ORIG REF: 029/ OTH REF: 005

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L 32521-65 EWT(m)/EPF(c)/EPR/EWP(t)/ETI IJP(c) JD/JW/JG

ACC NR: AP6005610 SOURCE CODE: UR/0233/65/000/003/0090/0095

AUTHOR: Dzhalilov, N. Z.; Aliyev, G. M.

ORG: none

TITLE: Electric properties of selenium single crystals

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 3, 1965, 90-95

TOPIC TAGS: semiconductor, selenium, selenium rectifier, semiconductor single crystal

ABSTRACT: Conductivity of Se crystals obtained from vapor and from melt was measured at -170 +215C, in vacuum (0.001 torr), in darkness. At room temperature, the conductivity was 2.3×10^{-6} and 1.1×10^{-7} mhos/cm for vapor and melt crystals, respectively. Curves of conductivity along and across C-axis vs. temperature are shown. The above data is compared with that avialable from Soviet and Western publications of 1938-64. Orig. art. has: 4 figures and 2 formulas.

SUB CODE: 09 / SUBM DATE: 10Mar65 / ORIG REF: 013 / OTH REF: 014

Card 1/1 vmb

L 39586-66 EWT(l)/EWT(m)/EWC(f)/EWG(m)/T/EWP(t) IJP(c) RDW/JD/GD/GG/GS
ACC NR: AT6001330 SOURCE CODE: UR/0000/65/000/000/0027/0029

AUTHOR: Aliyev, G. M.; Larionkina, L. S.; Dzhalilov, N. Z. 21 20 B+1

ORG: none

TITLE: The production of selenium single crystals 27 14

SOURCE: AN AzerbSSR. Institut fiziki. Selen, tellur i ikh primeneniye (Selenium, tellurium and their utilization). Baku, Izd-vo AN AzerbSSR, 1965, 27-29

TOPIC TAGS: selenium, single crystal growth, single crystal production, growth rate, pressure dependence, illumination, ultra high purity metal, heat treating furnace

ABSTRACT: Methods of increasing the normally slow growth rate of selenium single crystals were studied. The growth rate is slow owing to the closed chain-like structure of the amorphous selenium molecules. The single crystals were grown from a vapor in a vacuum and also under slight pressure of argon or helium. Three tubes made of Mo glass (50 cm high and 3.5 cm in diameter) were filled with powdered selenium of 99.99999% purity to a height of about 6 cm and evacuated to 10^{-3} mm Hg pressure; two of these were then filled with argon and helium respectively to a pres-

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L 39586-66
ACC NR: AT6001330

sure of 1 atm. All the tubes were then placed in a cylindrical furnace and heated to 260°C (a schematic of the apparatus is shown). After 8 days at 260°C, the tubes were quickly removed from the furnace. On the walls of all the tubes, as a result of the removal from the furnace, needlelike crystals grew away from the wall toward the interior and slightly downwards. After crystallization, the tube walls were covered with a red deposit in the case of helium and argon and with a gray deposit for the vacuum. For the vacuum-grown crystals the needles were short and cactus-like, while in argon and helium the growth was typified by a uniform density of needles of lengths varying from 0.5 to 1.5 cm; in helium the needles were slightly longer. An x-ray rotating pattern of a needlelike single crystal of selenium is shown. The increased growth rate of the selenium resulted in the longer crystals. The lack of data on the thermal, electrical and photoelectrical properties of selenium single crystals is attributed to the difficulties encountered in growing selenium crystals. The authors express their gratitude to K. P. Mamedov for the x-ray pattern. Orig. art. has: 3 figures.

SUB CODE: 20 SUBM DATE: 10Mar65/ ORIG REF: 002/ OTH REF: 003

Card 2/2 11b

L 04971-67 EWT(m)/EWP(w)/EWP(t)/ETI/EWP(k) LJP(c) JD
ACC NR: AP6023950 SOURCE CODE: UR/0233/65/000/006/0069/0074

AUTHOR: Akhundova, E. G.; Askerov, Ch. M.; Aliyev, G. M.; Abbasov, R. G.

ORG: none

TITLE: Effect of sulfur, chlorine and dysprosium impurities on the electrical conductivity of hexagonal and liquid selenium

SOURCE: AN AzerbSSR. Izv. Ser fiz-tekhn i matem n, no. 6, 1965, 69-74

TOPIC TAGS: sulfur, chlorine, dysprosium, semiconductor conductivity, selenium, electric conductivity

ABSTRACT: In order to clarify the influence of impurities on the formation of current and the jump in the electrical conductivity σ of selenium on melting, the effect of S, Cl and Dy on the σ of selenium of brands B_3 and B_4 (respectively 99.999 and 99.9999% pure) in the hexagonal modification and in the liquid state including the melting range was studied. Fig. 1 shows the curve of σ vs. the concentration of impurities. It is seen that Dy increases σ by a factor of 10, and that the higher the concentration of Cl, the more slowly σ reaches a maximum. This indicates that Dy impurities can be studied in the production of selenium rectifiers and can be used to replace the volatile Cl impurities. Cl strongly increases σ in B_4 selenium, whereas S strongly decreases it. A study of the temperature dependence of σ showed that σ in the solid state and its jump on melting change substantially with the impurity concentrations. Cl acts like oxygen, creating acceptor levels in Se, and thus increases

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ACC NR: AP6023950

the current carrier concentration and hence σ. The decrease in σ caused by S is apparently due to the fact that the acceptor action of oxygen is partly offset by sulfur impurities, which decrease the carrier concentration and hence σ. The jump in σ on melting is due to the presence of impurities in selenium which after melting become inactive. In conclusion, authors thank Prof. G. A. Abdullayev for his steady interest and useful suggestions. Orig. art. has: 5 figures, 1 table and 1 formula.

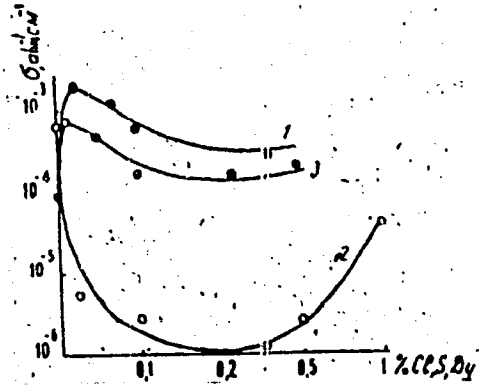

Fig. 1. Electrical conductivity of selenium vs. concentration of Cl, S and Dy impurities: 1 - Se+%Cl; 2 - Se + %S; 3 - Se + %Dy.

SUB CODE: 11,20 SUBM DATE: none/ ORIG REF: 008/ OTH REF: 009

Card 2/2

L 32951-66 EWT(m)/EWP(t)/ETI IJP(c) RDW/JD/JG

ACC NR: AP6017058 (N) SOURCE CODE: UR/0233/65/000/004/0084/0089

AUTHOR: Veliyev, M. I.; Aliyev, G. M.

ORG: none

TITLE: Effect of sodium on the heat conductivity and density of selenium

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 4, 1965, 84-89

TOPIC TAGS: selenium, heat conductivity, sodium

ABSTRACT: Density (δ) and heat conductivity (λ) measurements were made on Se (99.9999% purity) containing 0.034, 0.17, 0.34, 0.85, 2, 3.4 at % Na. The temperature function of λ is expressed by $\lambda \sim T^{\alpha}$. For amorphous Se, λ has a maximum for 0.17 at % Na and for crystalline Se, λ has a minimum for 0.34 at % Na, after which the properties of both approach those of pure Se. The absolute values of α decrease with an increase in impurity content. With the addition of up to 0.034 at % Na, α increases to 0.153 g/cm^3; further increase to 0.85 at % decreases α to 0.068 g/cm^3. Measurements of x-ray and pycnometric densities of polycrystalline Se and the addition of Na confirm the assumption that the Se has vacancies and pores. Orig. art. has: 3 formulas, 2 tables, 2 figures.

SUB CODE: 11, 20/ SUBM DATE: 10Mar65/ ORIG REF: 010/ OTH REF: 002

Card 1/1

L 26586-66 EWT(1)/EWT(m)/ETC(f)/EWG(m)/EWP(j) IJP(c) RDW/JD/RM

ACC NR: AP6011427 SOURCE CODE: UR/0020/66/167/004/0782/0784

AUTHOR: Aliyev, G. M.; Abdinov, D. Sh.; Mekhtiyeva, S. I.

ORG: Institute of Physics, Academy of Sciences, AzerbSSR (Institut fiziki Akademii nauk AzerbSSR)

TITLE: Selenium as a polymer semiconductor and the mechanism of its conductivity

SOURCE: AN SSSR. Doklady, v. 167, no. 4, 1966, 782-784

TOPIC TAGS: selenium, polymer structure, semiconductor material, semiconductor conductivity, thermoelectric power, Hall effect, liquid state, carrier density, electric conductivity

ABSTRACT: In view of the fact that the mechanism of conductivity of selenium has not been fully explained and the experimental data contradictory, that the influence of different impurities, especially oxygen, on the electrical properties of selenium has not been clarified, nor has the melting of selenium and its liquid state been studied, the authors present the results of a comprehensive investigation of the electric conductivity, thermoelectric power, and Hall effect in solid and liquid selenium (from 20 to 450°), including the melting region. The experiments were made with very pure selenium type B_5 (99.9999%) before and after removal of oxygen, and with different degrees of oxidation and with different amounts of oxygen-compensating impurities (Sb, Cd, Mn). The electric conductivity (σ) of solid and liquid selenium increases with the temperature exponentially, and experiences an abrupt decrease during melting. The carrier density is found to be independent of the temperature (~10^{15} cm^{-3}). The jumplike decrease in σ on melting is due both to the decrease in the

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concentration and a decrease in the mobility. The constancy of the carrier density indicates that the crystalline and liquid selenium are impurity semiconductors and all the impurity centers are ionized. Removal of the oxygen decreases the conductivity ~~and~~ ably and eliminates the discontinuity at the melting point. Similarly, elimination of the oxygen eliminates also the Hall effect. It is concluded that the elimination of oxygen is accompanied by a decrease in the carrier density by ~100 times and in the carrier mobility by ~10 times. It is therefore assumed that the oxygen atoms in the polymer chain of selenium produce acceptor centers thus increasing the hole density, and decrease the intermolecular barriers, thus increasing the carrier mobility. It is therefore concluded that selenium, like organic semiconductors, is very sensitive to the method of preparation and heat treatment. The authors are grateful to Professor G. B. Abdullayev for directing the work and Doctor of Physical-Mathematical Sciences M. I. Klinger for valuable advice. This report was presented by Academician V. A. Kargin 23 July 1965. Orig. art. has: 2 figures an 1 formula.

SUB CODE: 20/ SUBM DATE: 23Jul65/ ORIG REF: 015/ OTH REF: 009

Card 2/2: BLG

L 07250-67 EWT(d)/EWT(m)/EWP(w)/EWP(v)/EWP(t)/ETI/EWP(k)/EWP(h)/EWP(l)
ACC NR: AP6028918 IJP(c) JD/RH SOURCE CODE: UR/0233/66/000/001/0077/0084

AUTHOR: Abdullayev, G. B.; Mekhtiyeva, S. I.; Abdinov, D. Sh.; Aliyev, G. M.

ORG: none

TITLE: New properties of high purity selenium

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 1, 1966, 77-84

TOPIC TAGS: selenium, chemical purity, oxidation, thermoelectric power, heat conduction, physical diffusion, activation energy, semiconductor conductivity

ABSTRACT: In view of the fact that many properties of selenium are still not understood, the authors have checked on the hypothesis that many of them are due to the presence of oxygen and oxygen complexes in the selenium. The authors have investigated selenium of special high purity (grades B_4 and B_5, with purity 99.9999 and 99.99999%) before and after de-oxidation, and also after oxidation. The methods for oxidation and measurements are indicated in earlier papers (FTT v. 6, 1020, 1964 and elsewhere). The parameters tested were the electric conductivity, the thermoelectric power, the thermal conduction, the activation energy during self-diffusion, the density, the microhardness after introducing impurities, and the effect of oxygen-compensating impurities (Cd, Sb, Mn, Tl, Na, S). The measurement results are presented in graphic form. Many of the phenomena are explained from the point of view that the oxygen impurities produced in selenium acceptor levels, whereas the addition of the impurities

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ACC NR: AP6028918

which oxidize easily is equivalent to de-oxidation. The latter makes selenium closer to an intrinsic semiconductor. It is concluded that the p-conductivity of selenium, the fact that the thermal conductivity, the electric conductivity, the density, and the microhardness go through a minimum when impurities are introduced, the anomalously large value of the scattering cross section, the stron decrease in the electric conductivity and thermoelectric power on melting, as well as other factors are connected with the presence of oxygen impurities and its complexes in the selenium. Evidence in favor of this conclusion is drawn from a comparison of numerous experimental data by others. The influence of oxygen on the rectifying properties of selenium is also discussed. Orig. art. has: 6 figures and 1 formula.

SUB CODE: 20/ SUBM DATE: 00/ ORIG REF: 032/ OTH REF: 017

Card 2/2

ACC NR: AP7002839 (A) SOURCE CODE: UR/0253/66/000/004/0087/0090

AUTHOR: Dzhalilov, N. Z.; Azizov, T. S.; Aliyev, G. M.

ORG: none

TITLE: Influence of electron bombardment on the electric conductivity of hexagonal selenium single crystals

SOURCE: AN AzerbSSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk, no. 4, 1966, 87-90

TOPIC TAGS: selenium, semiconductor single crystal, electric conductivity, electron bombardment, crystal defect, annealing

ABSTRACT: The authors present the results of an investigation of the influence of electron bombardment on the electric conductivity of single crystals of hexagonal selenium grown from the vapor phase and from the melt. The resistance was measured with a dc bridge in conjunction with a mirror galvanometer. The bombardment and the measurement were at 300K, with the samples kept in darkness prior to the measurements to eliminate the effect of light on the conductivity. The bombardment was with 5-Mev electrons from an accelerator, in pulses of 3 μsec length and a repetition frequency 400 cps. The results show that bombardment increases the conductivity from 4×10^{-5} $(ohm\text{-}cm)^{-1}$ in darkness to 6.8×10^{-4} within a few minutes, and then gradually to 8×10^{-4} after ninety minutes. The increase in conductivity is due to defects in the structure produced by the electron bombardment and to the ionizing effect of the

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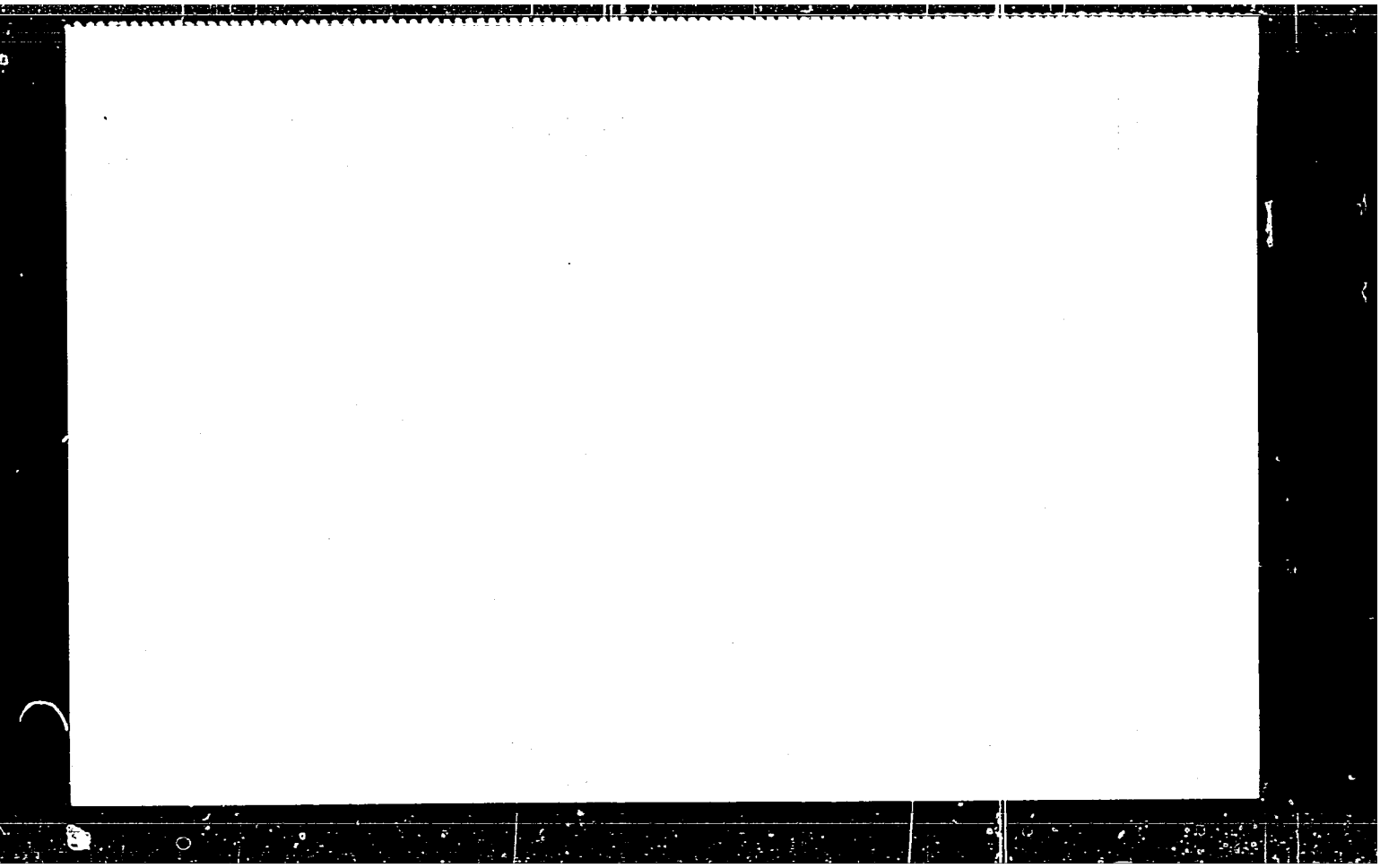
ACC NR: AP7002839

irradiation on the impurity atoms. The estimated maximum energy transferred to the selenium atom by bombarding electrons of energy 1 and 3 Mev is 82 or 729 ev respectively. The tests have shown that annealing of the sample after the bombardment rapidly returns the conductivity to its initial value. While the variation of the electric conductivity of selenium as a function of the bombarding electron flux density agrees with that of germanium, the behavior of the selenium after bombardment differs from that of germanium or silicon, in that no special annealing is necessary to revomve the radiation defects. Orig. art. has: 1 figure and 1 formula.

SUB CODE: 20/ SUBM DATE: 00/ ORIG REF: 003/ OTH REF: 004

Card 2/2



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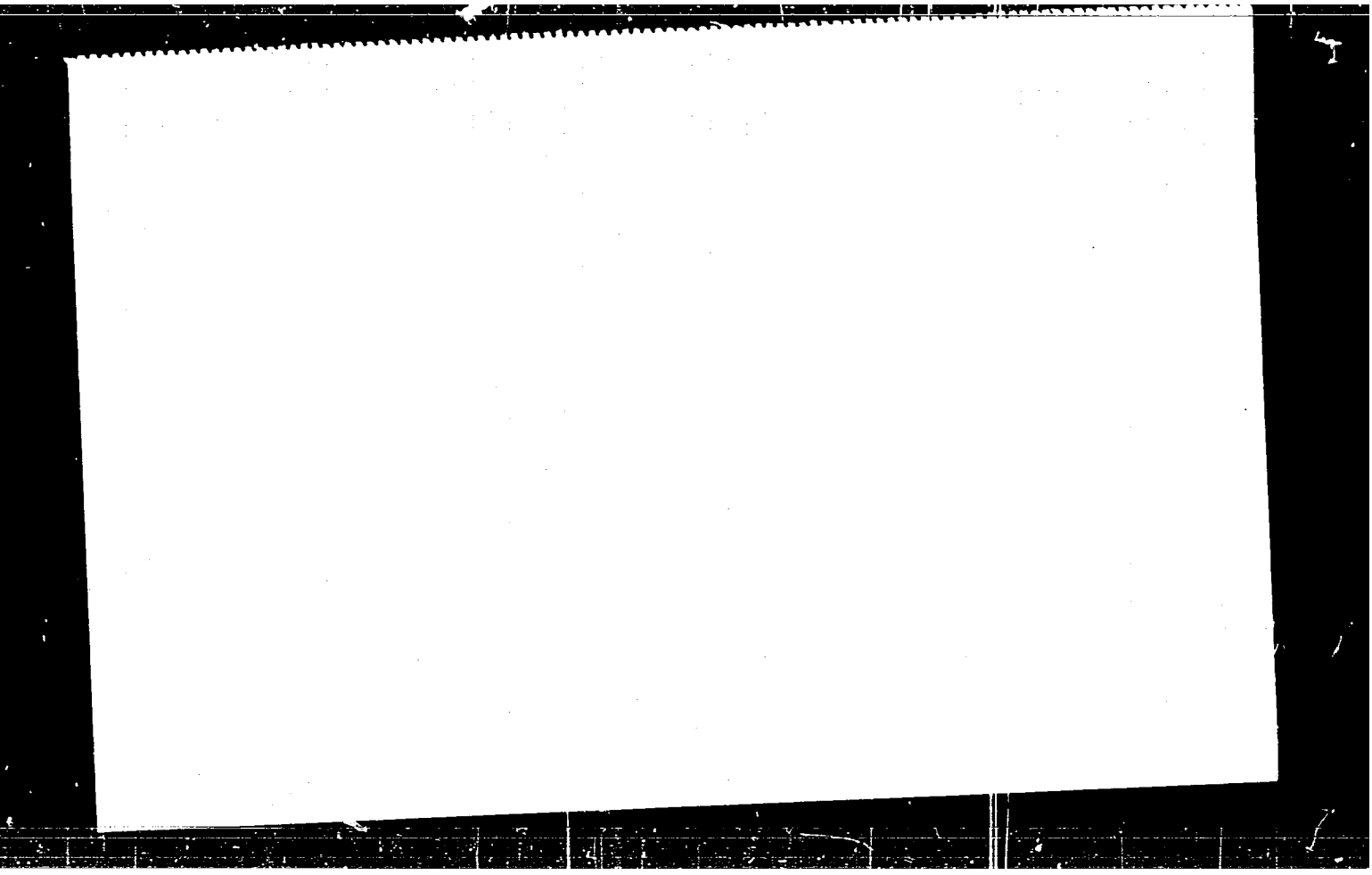

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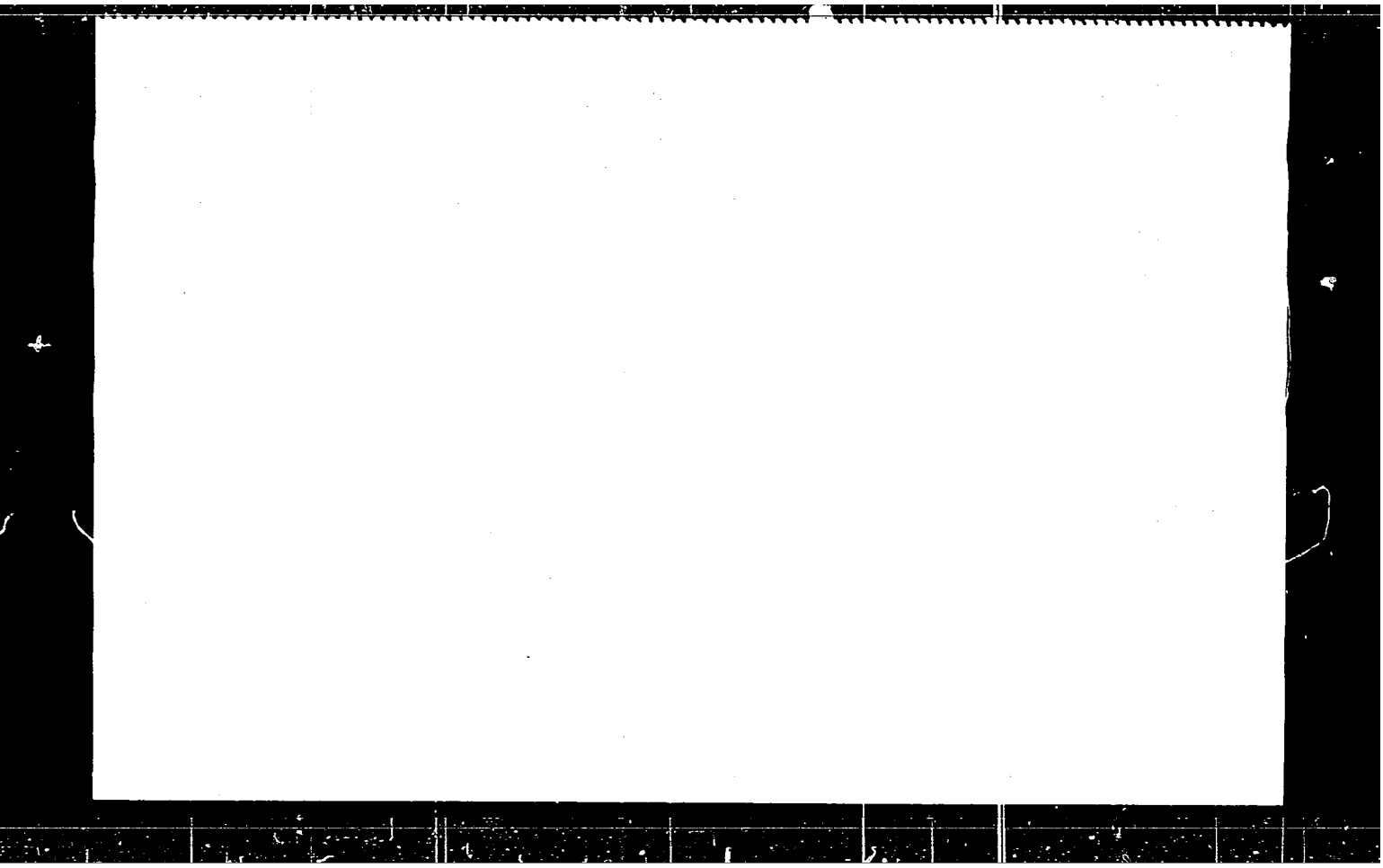

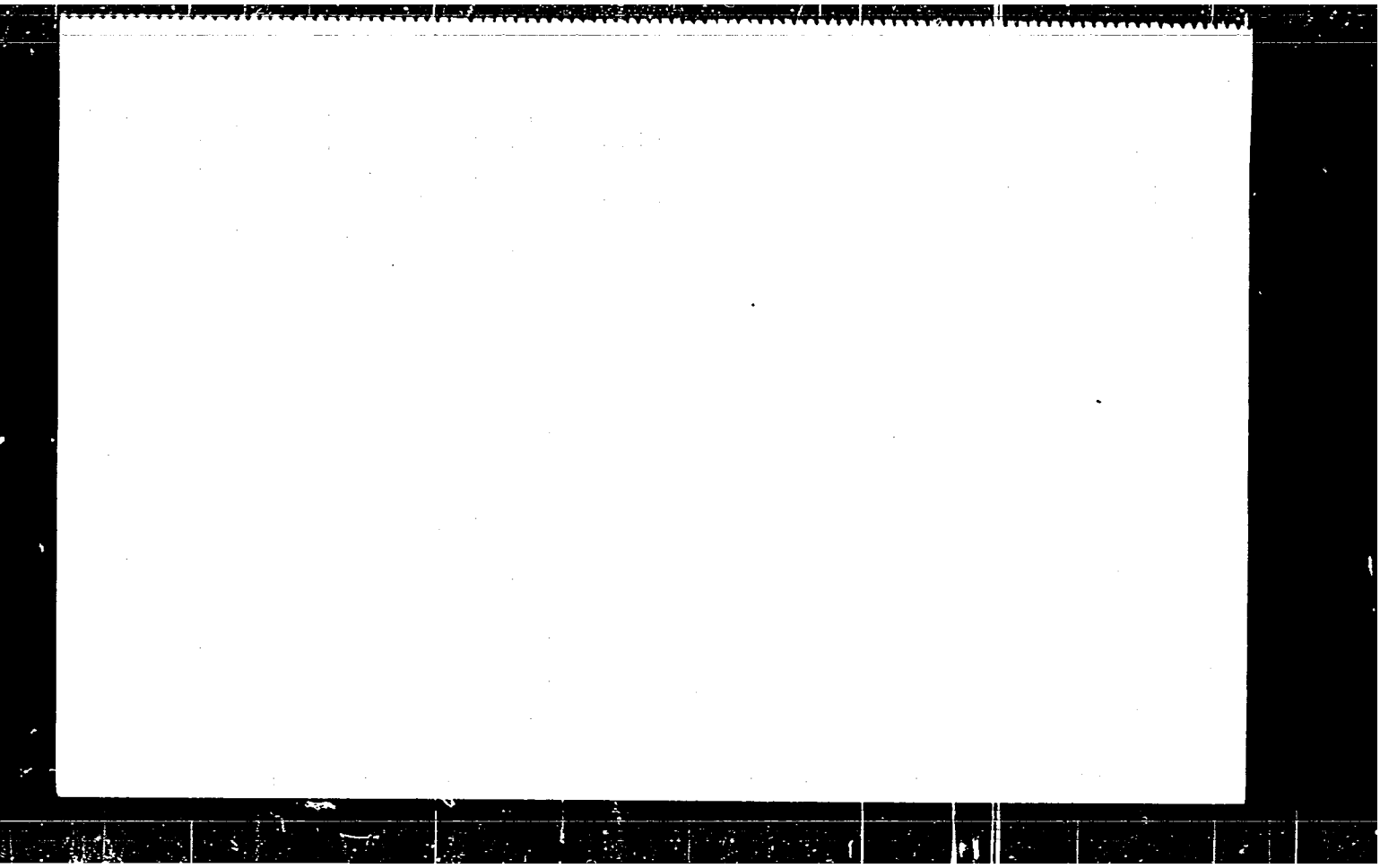

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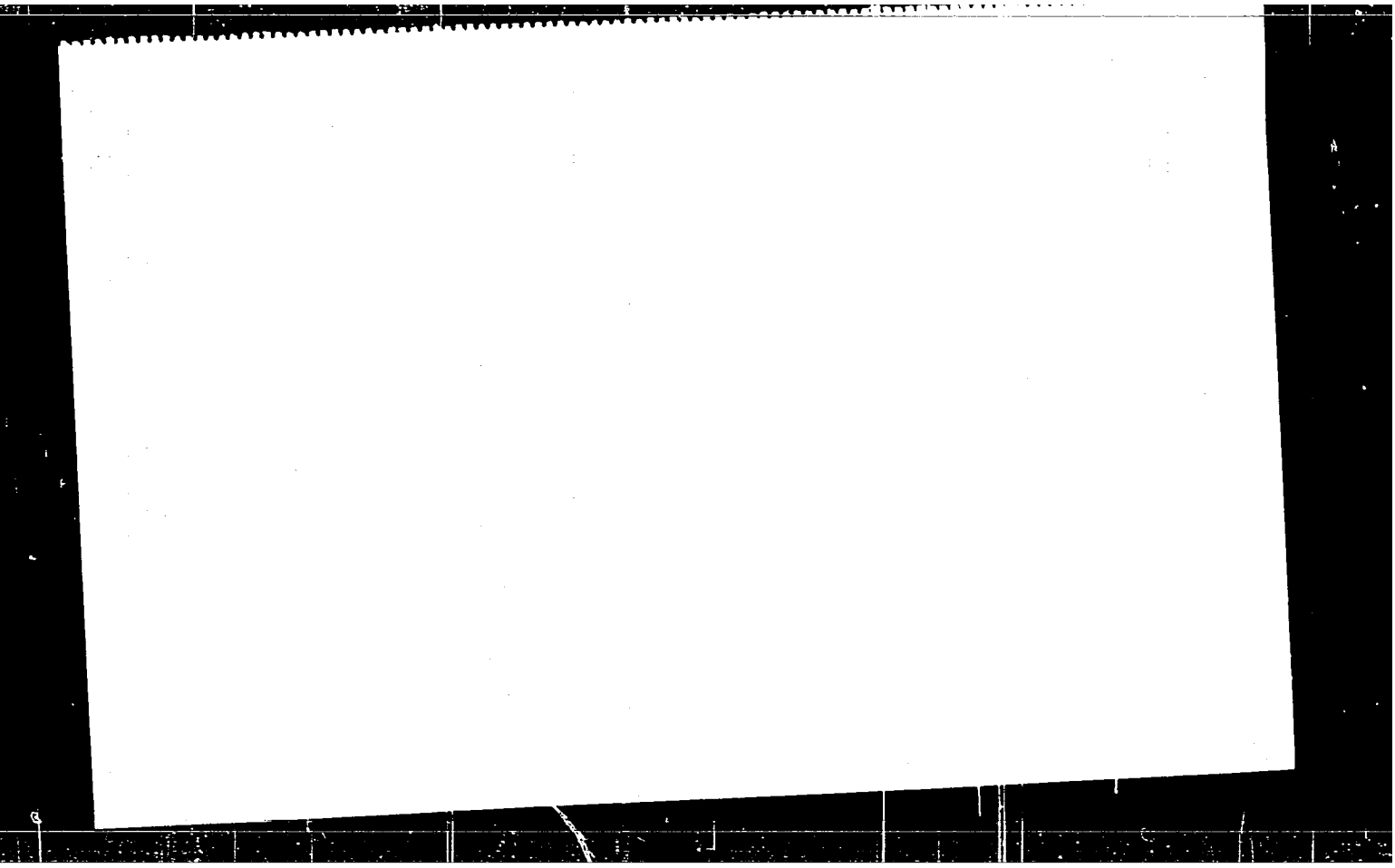

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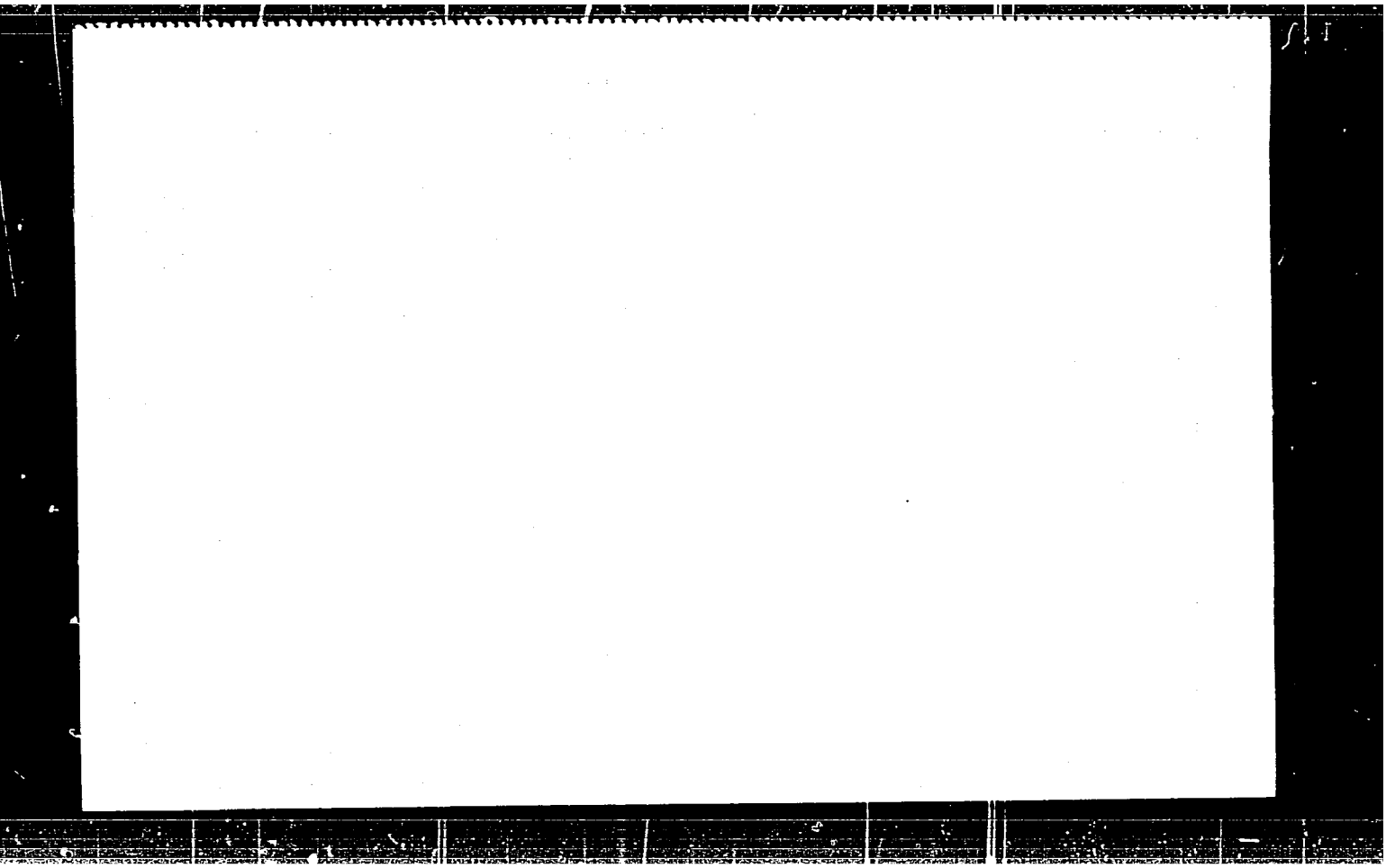

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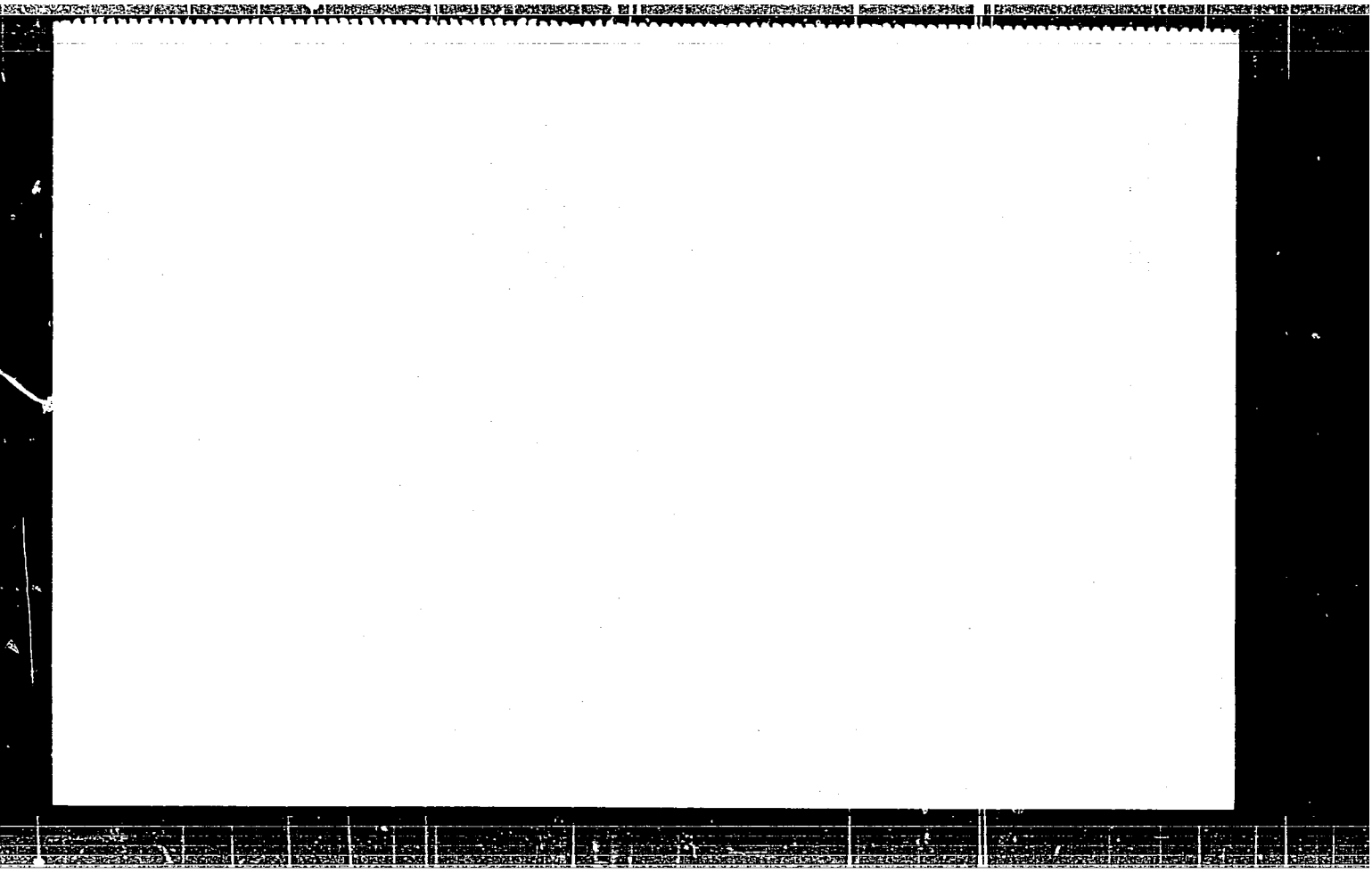

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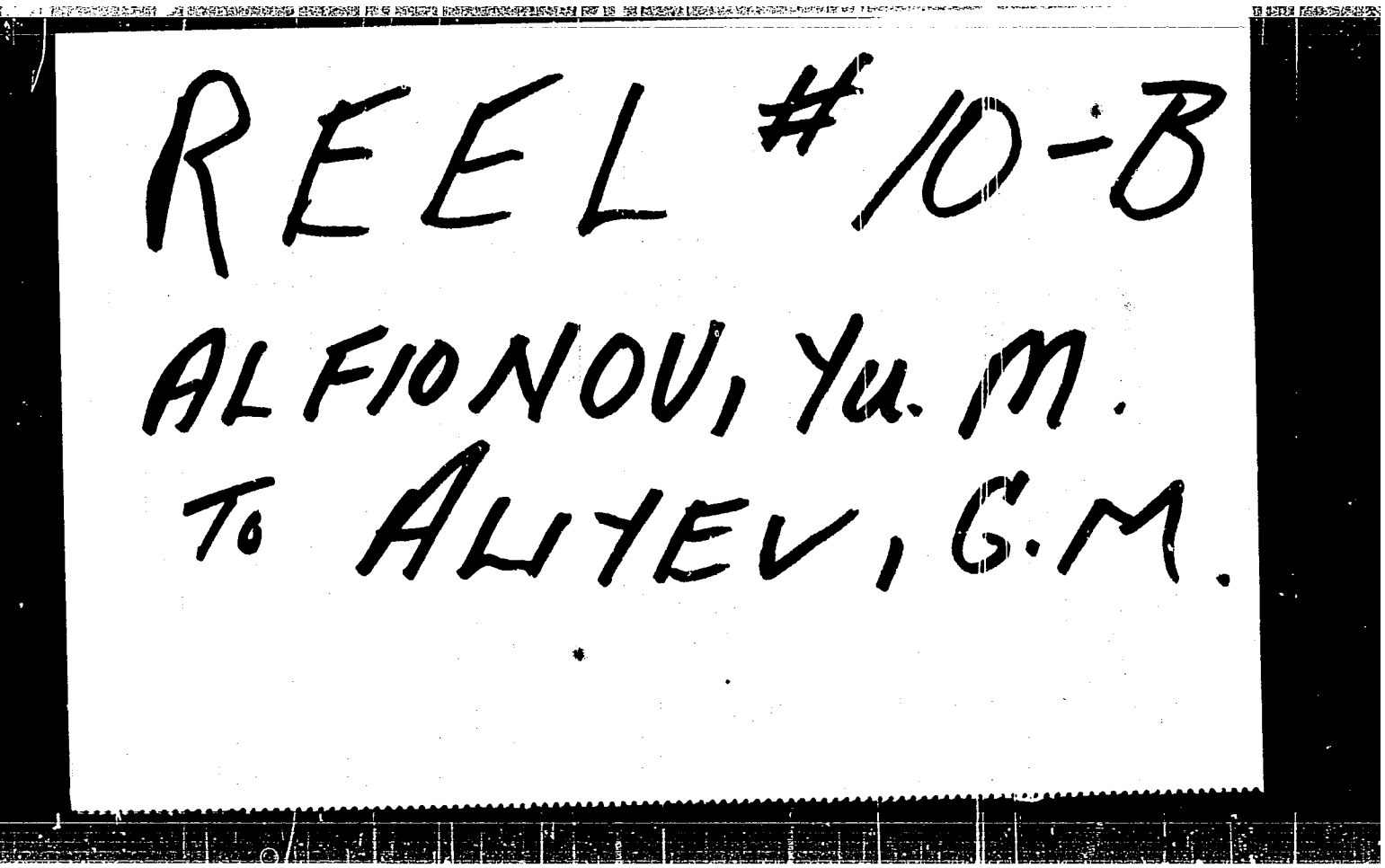

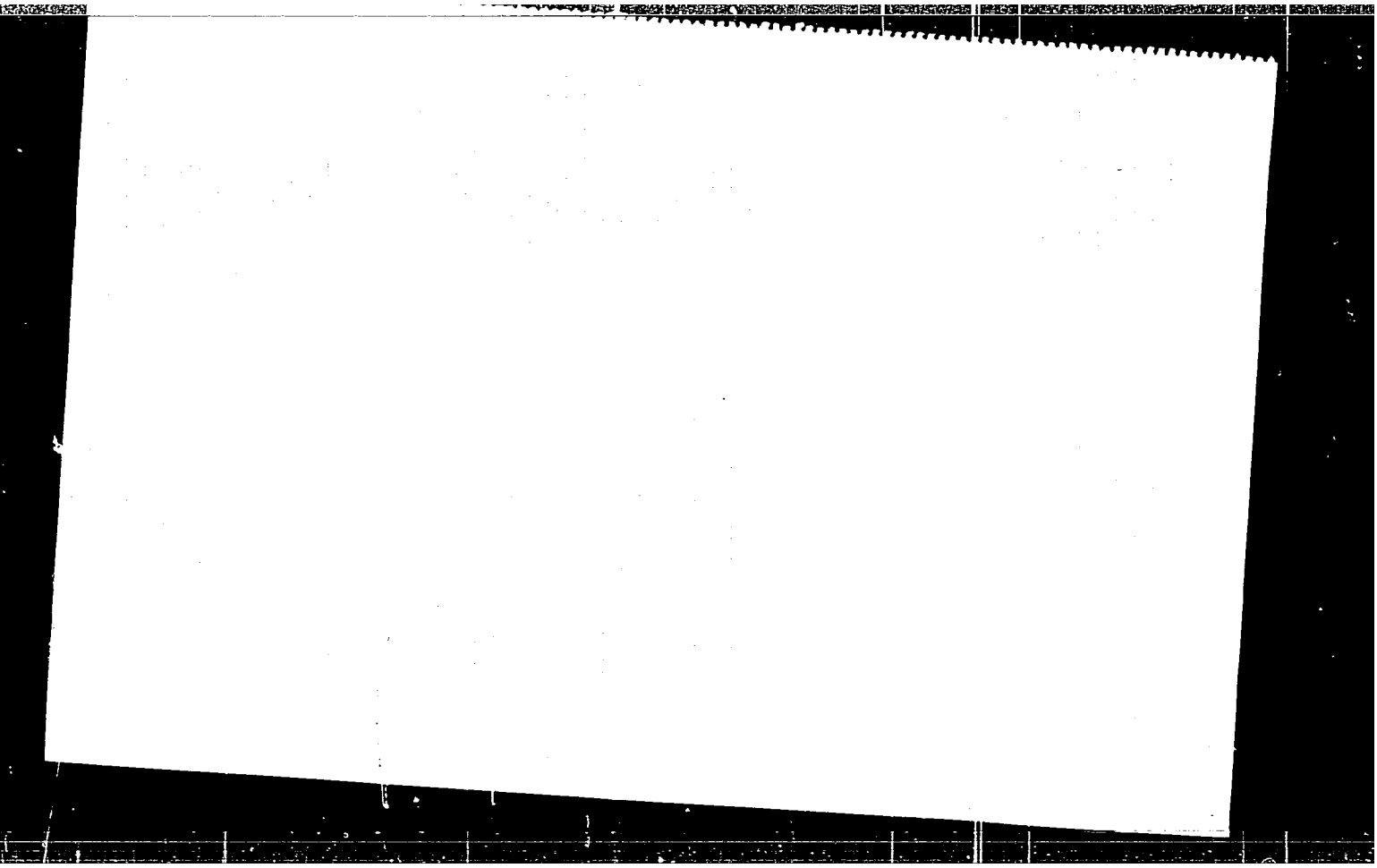

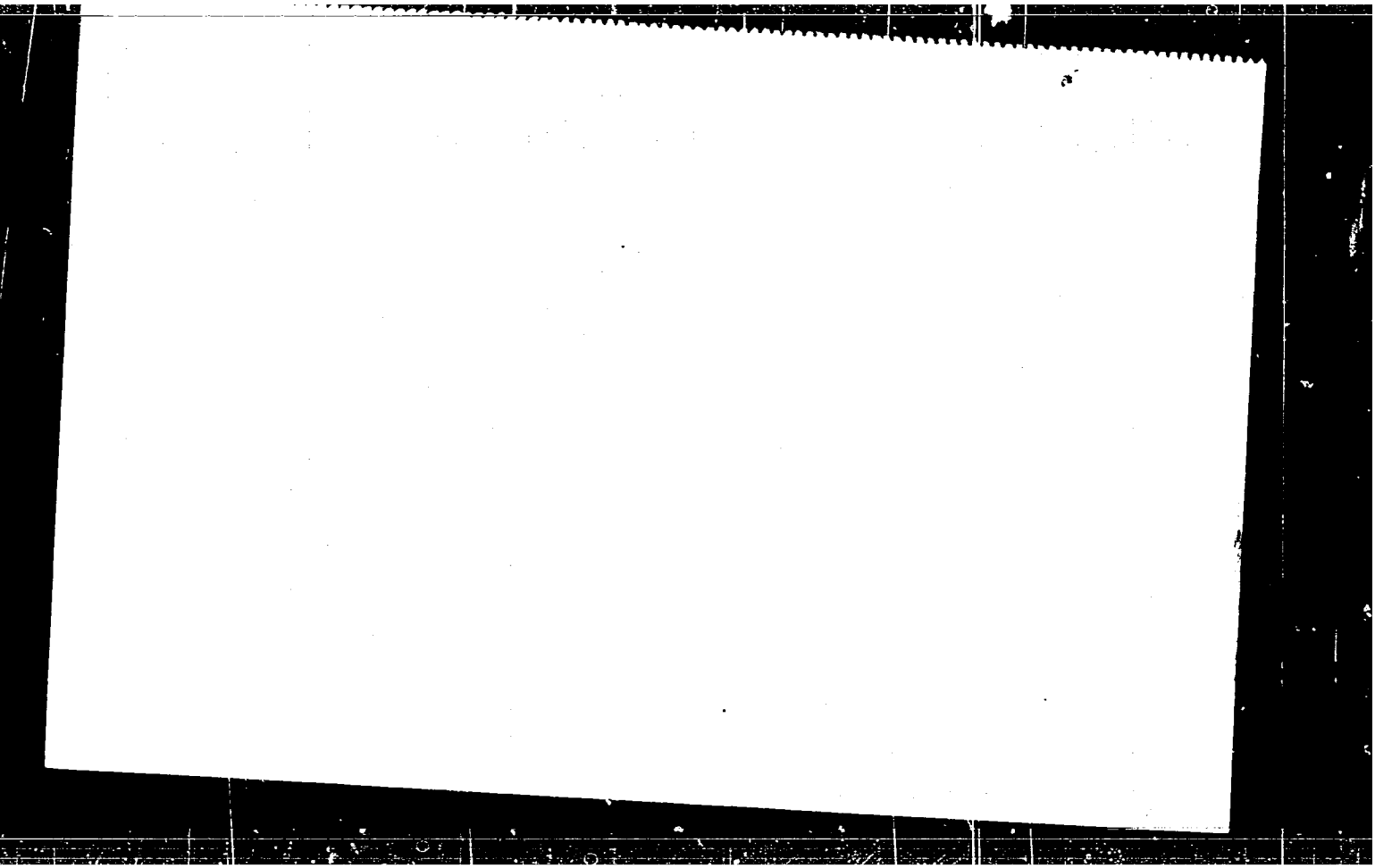

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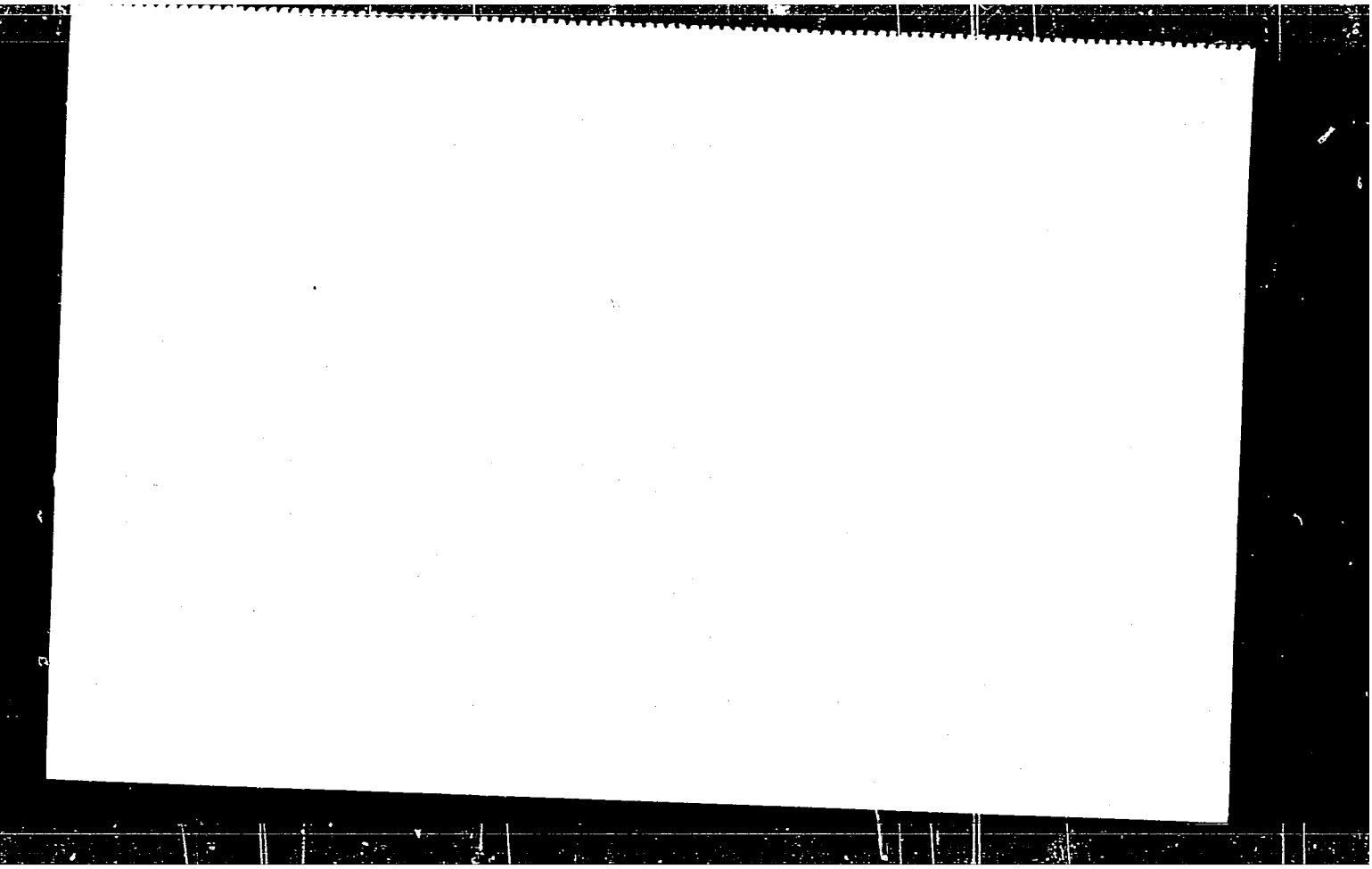

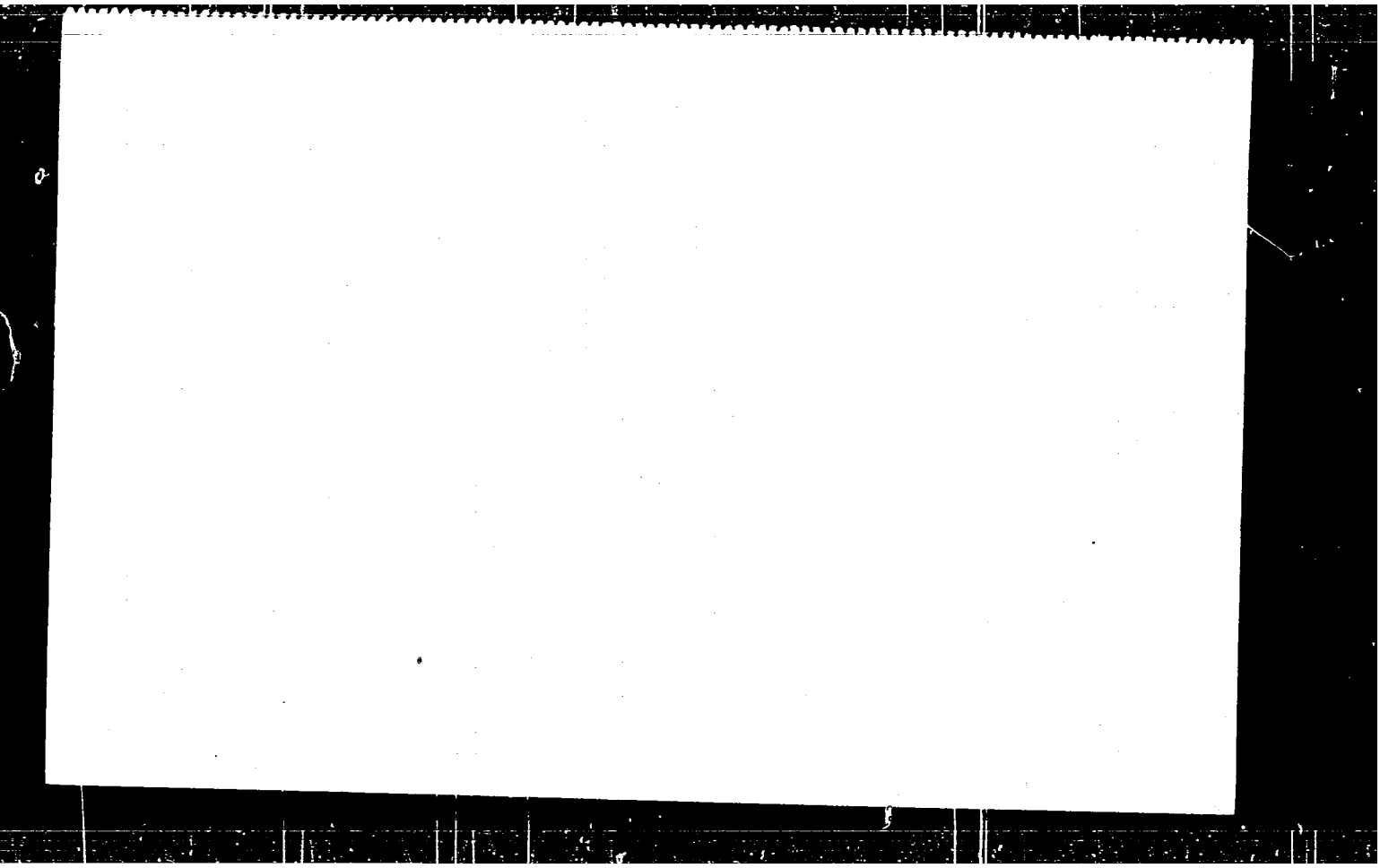

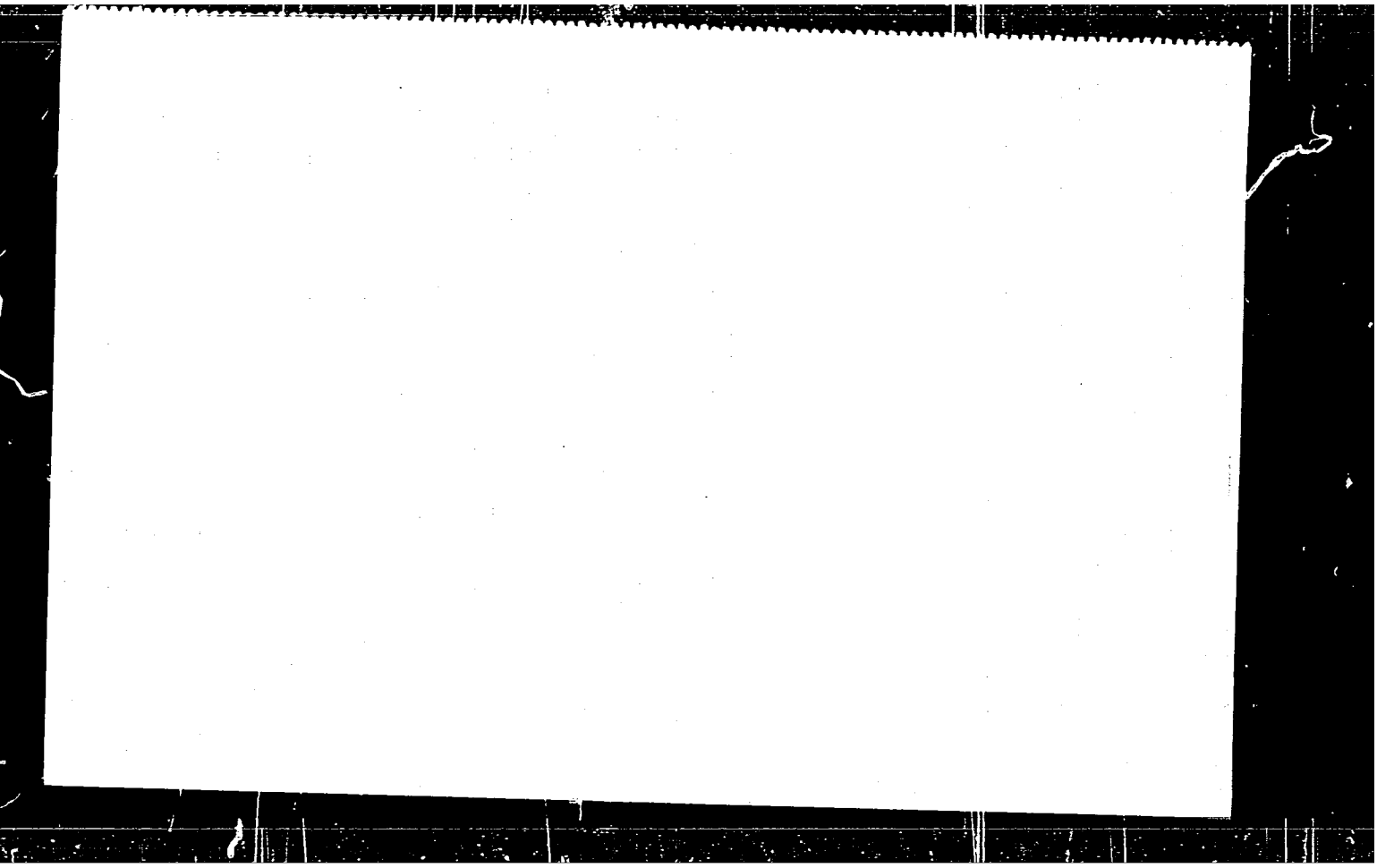

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