Thermal Treatment of Porcelain. (Cont.) 112-2-2713

tempering as well as during cooling. Optimum thermal treatment of products made from electro-technical porcelain ( ) may be ensured by annealing (removing the permanent stresses), or by creating reinforcing (compression) stresses on the surface of the product by tempering. Contemporary 110, 220 and 400 - kv insulators have a very complicated form and it is difficult to produce evenly distributed compression stresses on their surface by tempering. Annealing is recommended as the optimum thermal treatment of insulators wherein practically no residual stresses develop. 11 bibliographic entries.

N.V.N.

Card 4/4

YASIYEVICH, V., kand.arkhitektury; PROTSENKO, O., arkhitektor, prepodavatel'; PORSIN, Yu., kand.tekhn.nauk, dotsent; KAMYSHNYY, N., doktor tekhn. nauk, prof.; LEVIN, I., kand.tekhn.nauk, dotsent; FRIDKIN, E., student; SEKACHEV, Yu., student; MILEVSKIY, V., student; VMIRNOV, A., student; KORNEYEVA, S., studentka; VYGODSKIY, B., student; MOSHKOV, V., student

What kind of program for the course in "Industrial Design?" Opinion of teachers and students. Tekh.est. no.5:20-21 My '65. (MIRA 18:6)

1. Kafedra nachertatel'noy geometrii i kafedra grafiki Lesotekhnicheskoy akademii imeni Kirova (for Porsin). 2. Moskovskoye vysshoye tekhnicheskoye uchilishche imeni Baumana (for Kamyshnyy, Korneyeva, Vygodskiy, Moshkov). 3. Moskovskiy avtomekhanicheskiy institut (for Levin, Smirnov). 4. Leningradskiy institut aviapriborostroyeniya (for Fridkin, Sekachev, Milevskiy).

L 44825-66 EWT(1)/EWT(m)/T/EWP(t)/ETI IJP(c) JD

ACC NR: AP6032016 SOURCE CODE: UR/0336/66/004/006/0201/0205

AUTHOR: Fridkin, F. M.; Gerzanich, Ye. I.; Groshik, I. I.; Lyakhovitskaya, V. A.

ORG: Institute of Crystallography, Academy of Sciences SSSR (Institut kristallografii Akademii nauk SSSR) 51 B

TITLE: Absorption edge in the semiconducting ferroelectrics SbSBr, BiSBr, and SbSI

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 4, no. 6, 1966, 201-205

TOPIC TAGS: ferroelectric material, semiconducting material, second order phase transition, phase transition, absorption edge, light absorption

ABSTRACT: To ascertain the behavior of the intrinsic absorption edge in a series of ferroelectrics of groups V, VI, and VII, which undergo low-temperature phase transitions, the authors investigated optical absorption in SbSBr, BiSBr, and SbSI in polarized light in the interval from +40 to -190C. The SbSBr, BiSBr, and SbSi single crystals were grown from the gas phase. The SbSBr and BiSBr crystals were in the form of thin needles (transverse dimension not larger than 0.1 mm, length 10 - 15 mm). The SbSI single crystals were larger (10 x 1 x 1 mm). All the investigated single crystals were rhombo-dipyramidal. The direction of the spontaneous polarization coincided with the twofold axis parallel to the needle axis. The measurements were made in a vacuum cryostat cooled with liquid nitrogen, with a temperature maintained accurate to 0.2C. The transmission spectra were investigated with a monochromator and

Card 1/2

ACC NR: AP6032016

a photomultiplier. The relation $\alpha^{1/2} \sim h\nu$ (α - absorption coefficient, $h\nu$ - photon energy) was satisfied for all three crystals in the entire investigated temperature interval, thus pointing to the indirect character of the transitions. In addition, the $\alpha^{1/2}$ vs. $h\nu$ curve of SbSBr had two straight-line sections, connected apparently with the absorption and emission of a phonon. The phonon energy determined from the difference between the energies corresponding to the two sections turned out to be 0.03 ev and independent of the temperature. No change in the shape of the absorption edge during the phase transition was observed in any of the crystals. A jump in the width of the forbidden band takes place in the region of the phase transition of all the ferroelectrics. A striking fact is the jump in the temperature coefficient of the forbidden-band width observed in the case of SbSBr in the paraelectric region at a temperature -103C, apparently due to a second-order phase transition. The behavior of BiSBr and SbSI is qualitatively the same. The results not only confirm the existence of ferroelectric phase transitions in SbSBr, BiSBr, and SbSI at -180, -170, and +22C respectively, but indicate unambiguously their character (first-order transitions). In addition to these transitions, singularities in the temperature dependence of the width of the forbidden band are observed in the paraelectric region for SbSBr and BiSBr and in the ferroelectric region for SbSI. These are apparently evidence of the existence of second-order phase transitions in these crystals. Orig. art. has: 1 figure.

SUB CODE: 20/ SUBM DATE: 09Jun66/ ORIG REF: 003/ OTH REF: 004

Card 2/2

FRIDKIN, I. A.

"Designs of Cable Couplins Used in MKS Mosenergo - Their Advantages and Disadvantages," "Operation of Cable Networks" (Eksploatatsiya kabeley i kabel'nykh setey), Gosenergoizdat, 1949, 384 pp.

BARANOV, Boris Mikhaylovich; POKLAD, Petr Grigor'yevich; SMIRNOV, Leonid Petrovich; FOMICHEV, Grigoriy Ivanovich; FRIDKIN, Iosif Aronovich; FAYERMAN, A.L., red.; BORUNOV, N.I., tekhn.red.

[Construction and use of cable lines] Sooruzhenie i ekspluatatsiia kabel'nykh linii. Moskva, Gos.energ.izd-vo, 1959. 542 p. (MIRA 13:3)

(Electric cables)

VOLCHKOV, Konstantin Konstantinovich; GRISHKAN, Boris Yakovlevich; ZARKHIN, Mikhail Markovich; MANN, A.K., kand.tekhn.nauk, retsenzent; BARANOV, B.M., inzh., retsenzent; POKLAD, P.G., inzh., retsenzent; SMIRNOV, L.P., inzh., retsenzent; FOMICHEV, G.I., inzh., retsenzent; FRIDKIN, I.A., inzh., retsenzent; SHCHEGLOV, A.P., inzh., red.; ZHITNIKOVA, O.S., tekhn.red.

[Line structures of municipal electric networks] Ekspluatatsiia setevykh sooruzhenii gorodskoi elektricheskoi seti. Pod red. A.P. Shcheglova. Moskva, Gos.energ.izd-vo, 1960. 394 p.
(MIRA 13:5)

1. Moskovskaya kabel'naya set' (for Baranov, Poklad, Smirnov, Fomichev, Fridkin).
(Electric power distribution)

FRIDKIN, Iosif Aronovich; FAYERMAN, A.L., red.; SHIROKOVA, M.M., tekhn.red.

[Laying cable lines in the ground] Prokladka kabel'nykh linii v zemle. Moskva, Gosenergoizdat, 1961. 55 p. (Biblioteka elektromontera, no.59) (MIRA 15:5)
(Electric cables) (Earthwork)

ATABEKOV, V.B.; KULESHOV, Ya.T.; FRIDKIN, I.A.; YABLONSKIY, L.S.; ALEKSEYEV, V.P., red.; BALKOVSKAYA, I.Z., red. izd-va; KHENOKH, F.M., tekhn. red.

[Handbook on municipal electric networks and substations] Spravochnik po gorodskim elektricheskim setiam i podstantsiiam. [By] V.B.Atabekov i dr. Moskva, Izd-vo MKKh RSFSR, 1963. 550 p. (MIRA 16:11)
(Electric power distribution--Handbooks, manuals, etc.)
(Electric substations--Handbooks, manuals, etc.)

FRIDKIN, Iosif Aronovich; FAYERMAN, A.L., red.

[Operation of 1-35 kv. cable lines] Ekspluatatsiia kabel'-nykh linii 1-35 kv. Moskva, Izd-vo "Energiia," 1964. 87 p. (Biblioteka elektromontera, no.111) (MIRA 17:4)

BARANOV, Boris Mikhaylovich; POKLAD, Petr Grigor'yevich; SMIRNOV, Leonid Petrovich; FOMICHEV, G.I.; FRIDKIN, I.A.; FEDOSENKO, R.Ya., nauchn. red.; SHUMILOVA, Ye.M., red.

[Construction and operation of municipal cable networks] Sooruzhenie i ekspluatatsiia gorodskikh kabel'nykh setei. Moskva, Vysshaia shkola, 1965. 321 p. (MIRA 18:7)

L 3384-66 EWT(1)/EWT(m)/EWP(t)/EWP(b) IJP(c) JD

ACCESSION NR: AP5023287 UR/0371/65/000/004/0003/0012 51 47 B

AUTHOR: Veldre, V. (Veldre, V. Ya); Lasa, T. (Lyash, A. V.); Rabiks, L. (Rabik, L. L.); Fridkins, L. (Fridkin, L. A.)

TITLE: Total effective cross sections of the excitation of atoms by electron impact in the classical approximation

SOURCE: AN LatSSR. Izvestiya. Seriya fizicheskikh i tekhnicheskikh nauk, no. 4, 1965, 3-12

TOPIC TAGS: collision cross section, excitation cross section, neon, argon, krypton, xenon

ABSTRACT: The problem of the collision of two electrons one of which is revolving around a nucleus, represents the three body problem and can be solved only with great difficulty. Therefore, practical calculations are made by considering the corresponding two body problem. The present article is an attempt to increase the accuracy of the solution within the framework of the two body problem. A table gives a comparison of the excitation cross sections obtained for the neon atom in different approximations and includes a comparison of experimental and

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L 3384-66

ACCESSION NR: AP5023287 4

theoretical data. The excitation cross sections of neon, argon, krypton, and xenon are given in atomic units. Orig. art. has: 4 formulas and 7 tables

ASSOCIATION: Institut fiziki AN Latv. SSR (Institute of Physics, AN LatSSR) 44,55

SUBMITTED: 26Feb65 ENCL: 00 SUB CODE: NP

NR REF SOV: 006 OTHER: 006

Inert gases

Card 2/2 Md

FRIDKIN, M.M.

Treatment of laryngeal tuberculosis by prolonged novocain block. Prob.tuberk., Moskva No.1:39-40 Jan-Feb 51. (CLML 20:6)

1. Of the Phthysiolaryngological Division of the Ukrainian Tuberculosis Institute (Director--Prof.B.M.Khmel'nitskiy).

FRIDKIN, M.M., kand.med.nauk; KRASNOSHCHEKOVA, A.M. (Khar'kov).

Treating tuberculosis of the respiratory tract by moist and dry inhalation of antibacterial aerosols. Vrach.delo no.10:1049-1053 O'58 (MIRA 11:11)

1. Oblastnoy gospital' invalidov Otechestvennoy voyny.
(TUBERCULOSIS)
(INHALATION THERAPY)

FRIDKIN, P. A.

USSR/Electricity - Electric Drives Sep 51

"Additional Losses of the Electric Drive With Arc-Shaped Stator and Methods for Decreasing Them," P. A. Fridkin

"Iz Ak Nauk SSSR, Otdel Tekh Nauk" No 9, pp 1288-1305

Reviews exptl data since 1932, when 1st arc-shaped stator was designed. Analyzes nature of addnl losses and compares theoretical premises with exptl results. Discusses various measures for decreasing losses, emphasizing decrease of gap toward stator ends as most expedient method. Analyzes effect of compensation coils on power losses. Submitted by Acad V. S. Kulebakin 18 Apr 51.

205T5

FRIDKIN, P.A.

S.A.

Sect. B

Machines

2669. The third main dimension of an arc-shaped stator. P. A. Fridkin. *Elektrichestvo*, No. 1, 41-5 (1952) *In Russian*.

621.313.043.2

The third main dimension is the central angle α of the stator arc. By comparison with a circular stator of an induction motor having optimum dimensions, the power losses, tan ϕ, the number of winding sections, total stator weight and weight of active materials will be reduced for an arc-shaped stator of enlarged diameter D_1 in the ratio $(D/D_1)^k$, where $k = 3$ for the number of winding sections, $k = 2$ for the weight of insulating materials, number of stator stampings and area of the active surface; $1 < k < 1{\cdot}5$ for the weight of the iron teeth, copper weight and the losses in these metals; $k = 1$ for the nominal tan ϕ, the iron weight of the stator and the losses in it; $2 < k < 2{\cdot}5$ for the total stator weight. These favourable features are offset by comparatively high final losses for arc-shaped stator motors with a small number of poles, the reduction of which remains an acute problem.

B. P. KRAUS

Leningrad Textile Inst. im. Kirov

PHASE I BOOK EXPLOITATION SOV/3762

Konferentsiya po magnitnoy gidrodinamike. Riga, 1958.

Voprosy magnitnoy gidrodinamiki i dinamiki plazmy; trudy Konferentsii. (Problems in Magnetohydrodynamics and Plasma Dynamics; Transactions of a Conference) Riga, Izd-vo AN Latviyskoy SSR, 1959. 343 p. Errata slip inserted. 1,000 copies printed.

Sponsoring Agency: Akademiya nauk Latviyskoy SSR. Institut fiziki.

Editorial Board: D.A. Frank-Kamenetskiy, Doctor of Physics and Mathematics, Professor; A.I. Vol'dek, Doctor of Technical Sciences, Professor; I.M. Kirko, Doctor of Physics and Mathematics; V.Ya. Veldre, Candidate of Physics and Mathematics; V.G. Vitol, Candidate of Physics and Mathematics; Yu.M. Kruzin'; and V.Ya. Kravchenko.

Ed.: A. Teytel'baum; Tech. Ed.: A. Klyavinya

PURPOSE: This book is intended for physicists working in the field of magnetohydrodynamics and plasma dynamics.

COVERAGE: This volume contains the transactions of a conference held in Riga, June 1958, on problems in applied and theoretical magnetohydrodynamics. The objects of the conference were the investigation of the basic trends in theoretical and applied magnetohydrodynamics, establishing contact between the people doing research in different branches of magnetohydrodynamics, and promoting the participation of theoretical physicists in problems in applied magnetohydrodynamics. More than 160 persons from different parts of the Soviet Union took part in the conference, and 55 papers were read. Similar conferences are to be held regularly in the future; the next such conference is scheduled to be held in Riga in June 1960. In this present collection of the transactions of the conference, most of the papers and comments on papers are presented by the authors themselves in an abridged form. The book is divided into two parts: the first part deals with problems in theoretical magnetohydrodynamics and plasma dynamics, and consists of 35 articles on such aspects of the problem as the application of magnetohydrodynamics in astrophysics (D.A. Frank-Kamenetskiy), magnetohydrodynamics and the investigation of cosmic-ray variations (L.I. Dorman), acceleration of plasma in a magnetic field (G.V. Gordeyev and A.I. Gubanov), stability of shock waves and magnetohydrodynamics (A.I. Akhiyezer). The second part, consisting of 35 articles, deals with problems of experimental magnetohydrodynamics, including the application of physical simulation for investigation of electromagnetic processes in liquid metals (I.M. Kirko) and the development of electromagnetic pumps (P.G. Kirillov), at the Institute of Physics of the Academy of Sciences, Latvian SSR. Several articles are devoted to induction pumps, electromagnetic crucibles, electromagnetic stirrers for molten metals, and their application in the metallurgical industry including schematic diagrams of their power-supply systems. References are given at the end of most of the articles.

AVAILABLE: Library of Congress

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Card 12/12

FRIDKIN, V.M.

Theory of high-frequency discharges. Vest.Mosk.un. 8 no.8:109-114 Ag '53.
(MLRA 6:11)

1. Kafedra elektronnykh i ionnykh protsessov.
(Electric discharges through gases)

USSR / Electricity

FRIDKIN, V.M.

G

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9594

Author : Rabinovich, A.D., Fridkin, V.N., Froyman, A.I.
Inst : Not given
Title : Application of Electrets in Measuring Technology (Survey)

Orig Pub : Izmerit. tekhnika, 1955, No 4, 31-34

Abstract : Survey article.

Card : 1/1

Fridkin, V.M.

USSR / Electricity G

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9620

Author : Froyman, A.I., Fridkin, V.M.
Inst : Institute of Crystallography, Academy of Sciences USSR, Moscow
Title : Investigation of the Hetero-Charge of Electrets Made of Carnauba Wax.

Orig Pub : Kristallografiya, 1956, 1, No 3, 342-350

Abstract : By determining the discharge current and subsequently integrating this current with respect to time, a study was made of the dependence of the value of the hetero-charge (Q) of an electret, made of pure carnauba wax, on the intensity (E) of the polarization is effected. It is established that in the range of E from 2.1 to 12 kv/cm, the value of Q is approximately the same as E at constant temperature. The process of formation of hetero-charge has an activation energy

Card : 1/2

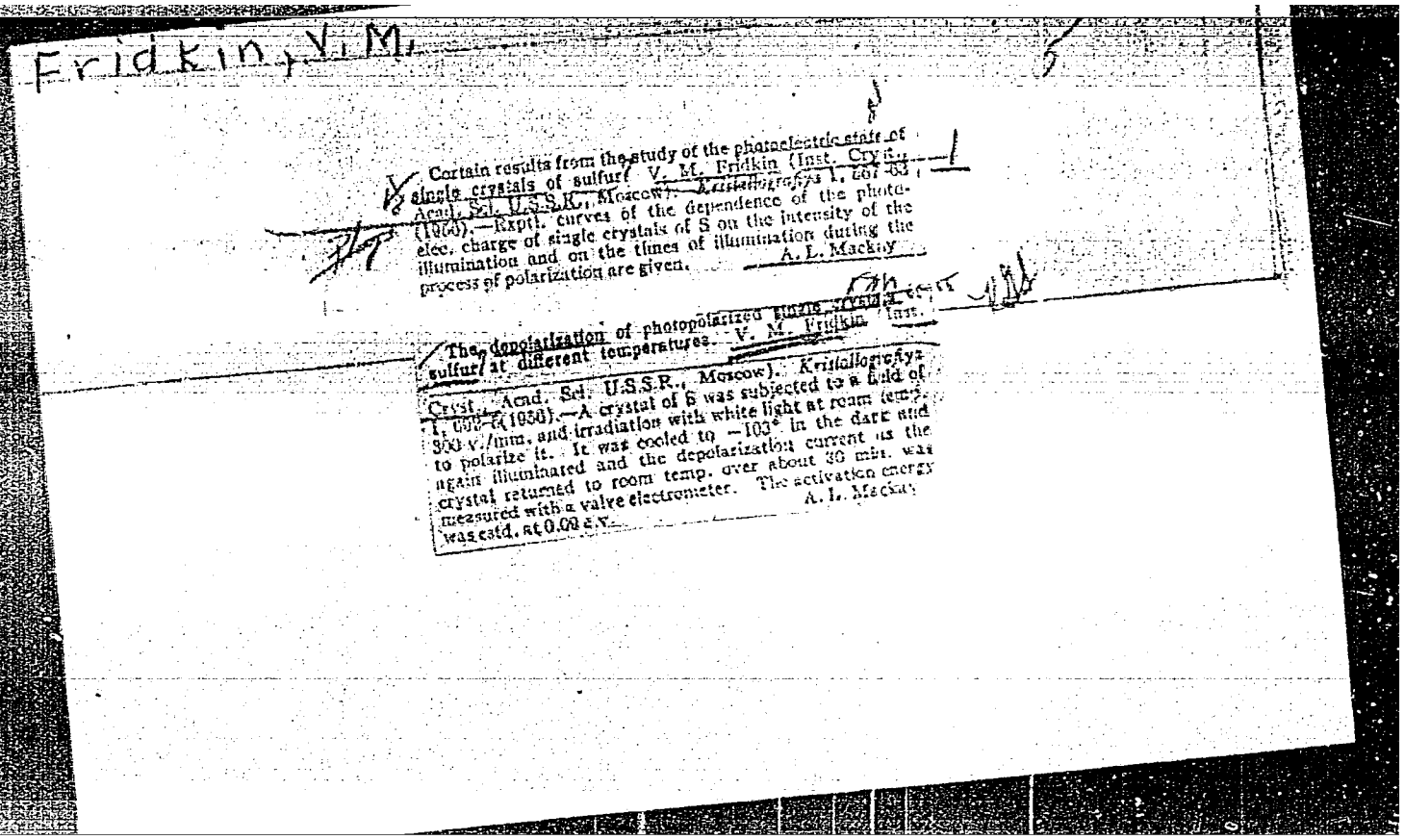
G

- USSR / Electricity

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9620

Abstract : of 18,500 cal/mol. Comparison of the experimental curves for the dependence of the discharge current on the time with the theoretical curves plotted under the assumption of a purely ionic mechanism of formation and destruction of Q, shows that in the case of good agreement between the rise and the position of the maximum, the decay of the experimental curves is considerably slower than that of the theoretical ones. For full interpretation of the phenomenon it is necessary to take into account, along with the displacement of the ions, also the orientation of the dipoles. A scheme and description for a measurement setup are given.

Card : 2/2



Fridkin, V. M.

Certain results from the study of the photoelectric state of single crystals of sulfur. V. M. Fridkin (Inst. Cryst., Acad. Sci. U.S.S.R., Moscow). *Kristallografiya* 1, 267–83 (1956).—Expt. curves of the dependence of the photoelec. charge of single crystals of S on the intensity of the illumination and on the times of illumination during the process of polarization are given. A. L. Mackay

The depolarization of photopolarized single crystals of sulfur at different temperatures. V. M. Fridkin (Inst. Cryst., Acad. Sci. U.S.S.R., Moscow). *Kristallografiya* 1, 680–6 (1956).—A crystal of S was subjected to a field of 300 v./mm. and irradiation with white light at room temp. to polarize it. It was cooled to −103° in the dark and again illuminated and the depolarization current as the crystal returned to room temp. over about 30 min. was measured with a valve electrometer. The activation energy was calcd. at 0.08 e.v. A. L. Mackay

FRIDKIN, V.M.

10 000. ELECTROPHOTOGRAPHY ON PHOTOELECTRETS.
V.M. Fridkin.

Kristallografiya, Vol. 2, No. 1, 130-3 (1957). In Russian.

A method is described for producing electrophotographic images on mono- and polycrystalline sulphur and on monocrystalline anthracene. Examples of the images are reproduced. A so-called metric method of investigating photoelectret state is suggested. R.F.S.Hearmon

FRIDKIN, V.M.; DELOVA, A.I.; GERASIMOVA, T.N.; BILYALETDINOV, Kh.S.

Some results of the study of electronic photography and electrostatic printing. Zhur.nauch.i prikl.fot.i kin. 2 no.4:286-292 Jl-Ag '57. (MLRA 10:7)

1. Nauchno-issledovatel'skiy institut poligraficheskogo mashinostroyeniya.

(Xerography)

FRIDKIN, V.M.

AUTHORS: Zheludev, I.S. and Fridkin, V.M. 70-5-28/31

TITLE: On Two Limiting Point Symmetry Groups of Polycrystalline Electrets (O dvukh predel'nykh tochechnykh gruppakh simmetrii polikristallicheskikh fotoelektretov)

PERIODICAL: Kristallografiya, 1957, Vol.2, No.5, pp. 705-706 (USSR)

ABSTRACT: A polycrystalline electret specimen of sulphur has earlier been shown to have the symmetry group ∞.m .(Fridkin, Kristallografiya, Vol.1, 557, 1956). A mixture of asphalt and NaCl dusts have been used for developing the charge pattern on the surfaces of the electrets as by friction the former becomes positively charged and the latter negatively. A specimen with the symmetry group m.∞:m has now been produced. A layer of polycrystalline sulphur 50 μ thick was evaporated on to an Al plate in vacuo and was then polarised by a field of 5 kV/cm and illuminated at 5 x 10^{-6} W/cm^2. It was then overlaid with a metallic raster with a pattern of 0.9 mm diameter holes, polarised in the reverse direction and illuminated at the same intensity for the same time (4 minutes). On dusting with the asphalt and salt powder a pattern became apparent showing a pattern with a non-polar texture of symmetry m.∞:m. The salt settled on the parts which had been exposed through the holes and

Card1/2 the asphalt on the remainder. This texture is non-piezo-electric

Pa 22.3

AUTHOR FRIDKIN, V.M., GERASIMOVA, T.N.,

TITLE Electric Photography on Luminophores.
(Elektrofotografiya na lyuminoforakh - Russian)

PERIODICAL Doklady Akademii Nauk SSSR, 1957, Vol 113, Nr 3, pp 571-572, (U.S.S.R.)
Received 6/1957 Reviewed 7/1957

ABSTRACT Experiments were carried out in order to obtain images on the surface of paper or metals which were coated with a luminescent layer which, at the same time, was photoconductive. The following material was used, [CdS, ZnS]Cu, which has its maximum photoconductivity at $\lambda = 340$ m, and [CdS, ZnS] Ag, which has its maximum photoconductivity at $\lambda = 44$ m. The surface of the layer could be charged in the dark by means of the corona discharge. The image on the surface of the layer was obtained by projecting an image on to the surface of the luminescent substance charged in this manner by means of a photoenlarging apparatus. The time of exposure corresponded to the relaxation period of the surface charge which had been previously measured for the respective layer. Developing was carried out by spraying the layer with inversely charged colored resin particles. The particles were charged by means of friction electricity. An additional peculiarity of electrophotography was the possibility of watching the luminescent substances in the dark while they were illuminated by ultraviolet light (with 365 mμ wavelength). Good results were also obtained with other photoconductive layers, as e.g. ZnO and CdS.

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All Sci. Res. Inst. for Polygraphical Machine Bldg.

orily. Besides, the rule of interchangeability is satisfied in the case of the production of the photoelectret. Therefore, the charge of thephoto electrete is a function of the product E. t at an arbitrary duration of polarisation t and at an arbitrary intensity of illumination E. With the help of the curves attached to the paper this rule of mutual replaceability was verified for a sulphur monocrystal. This rule is complied with at every intensity of illumination employed for the polarisation of the sulphur monocrystal. The theoretical deduction and the experimental verification of the rule of mutuality in photoelectrets are quite independently of interest. The saturation effect mentioned above occurring at the investigation of the dependence of the charge on the duration of polarisation and on the intensity of illumination may be explained by the fact, that only an insignificant part of the free levels is filled up by electrons. This is verified by the experimental investigation of the dependence of the charge of the photoelectret on the intensity of the polarising field. If the temperature effect is taken into consideration, the rule of interchangeability no longer holds. There are 4 figures, 11 references, 10 of which are Slavic.

PRESENTED: July 27, 1957, by A. V. Shubnikov, Academician
SUBMITTED: July 27, 1957

Card 2/2

FRIDKIN, V.M.

Zheludev, I.S. and V.M. Fridkin. [Institut kristallografii AN SSSR (Institute of Crystallography, AS USSR)] On the "Photoelectret" [after G. Nadzhakov] and "Thermophotoelectret" State of Monocrystalline Sulfur

(The Physics of Dielectrics; Transactions of the All-Union Conference on the Physics of Dielectrics) Moscow, Izd-vo AN SSSR, 1958. 245 p. 3,000 copies printed.

This volume publishes reports presented at the All-Union Conference on the Physics of Dielectrics, held in Dnepropetrovsk in August 1956 sponsored by the "Physics of Dielectrics" Laboratory of the Fizicheskiy institut imeni Lebedeva AN SSSR (Physics Institute imeni Lebedev of the AS USSR), and the Electrophysics Department of the Dnepropetrovskiy gosudarstvennyy universitet (Dnepropetrovsk State University).

FRUKIN

Fridkin, V.M., Cand Phys-Math Sci--(diss.) " Study of the photoelectric state in certain monocrystals, and the phenomena of electrophotography on the photoelectrets)." Len, 1958. 11 pp (Acad Sci USSR. Inst of Crystallography), 100 copies. Bibliography- List of author's works pp 10-11 (15 titles) (KL,25-58,107)

FRIDKIN, V.M.

SOV/77-4-2-15/18

23(4) 23 (5)

AUTHOR: Lyalikov, K.S.

TITLE: Successes of Soviet Electrophotography (Uspekhi sovetskoy elektrofotografii) A Scientific and Technical Conference on Questions of Electrography (Nauchno-tekhnicheskaya konferentsiya po voprosam elektrografii)

PERIODICAL: Zhurnal nauchnoy i prikladnoy fotografii i kinematografii, 1959, Vol 4, Nr 2, pp 149-152 (USSR)

ABSTRACT: This is an account of a scientific and technical conference on electrography, the first to be held in the Soviet Union and evidently in the world. It was organized in Vil'nyus on December 16-19, 1958 by the Soviet narodnogo khozyaystva Litovskoy SSR (Council for National Economy of the Lithuanian SSR), the Gosudarstvennyy nauchno-tekhnicheskiy komitet Soveta ministrov Litovskoy SSR (State Scientific and Technical Committee of the Council of Ministers of the Lithuanian SSR) and the Nauchno-issledovatel'skiy institut elektrografii (Scientific Research Institute of Electrography). The conference, attended by over 300 scientific workers, was opened by the Deputy Chairman of the Council for National Economy of the Lithuanian SSR P.A. Kul'vets, after which the director of the Institute for Electrography, I.I.Zhilevich, reviewed the state and prospects for development of electrography in the USSR. He stated that research in this field should be carried out along the following lines: a) a search for new photo-active materials with high dark resitance; b) physical research into the internal photoeffect; c) development of photosemiconductor layers; d) development of the theory of the electrophotographic process. K.S. Lyalikov (speaking also for O.G. Popova) gave a report in which he suggested determining the light sensitivity of electrophotographic layers in GOST units. E.Z. Plavina (speaking also for I.I.Zhilevich, L.I.Kyun'ko, N.N.Markevich, P.I. Kalinauskens and O.K. Suveyzdis) reported on some research on the sensitization of a semiconductor in electrophotographic layers. V.M. Fridkin gave a report on highly sensitive electrophotographic layers and an electrophotocopying device, and reviewed the formation process of the latent electrophotographic image on the basis of the zonal theory. He also described the design of an electrosensitometer for determining sensitivity by the relaxation period of a charge on the surface of the layer, and the circuit of an electrophotographic copying device. Anfilov finished describing the latter and then spoke on the mechanics and kinetics of the development of the latent electrophotographic image in liquid developers.

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APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000513710014-9"

SOV/77-4-2-15/18

Successes of Soviet Electrophotography; A Scientific and Technical Conference on Questions of Electrography

K.M. Vinogradov described some of the features of the cascade and liquid methods of electrophotographic development. Yu.Ye. Karpeshko devoted his report to the criterion of light sensitivity of the elctrophotographic process. After the reports, a discussion took place on methods of determining the light sensitivity of electrophotographic layers. A.N. Chernyshev spoke on the prospects of developing polygraphic processes using electric and magnetic forces. O.V. Gromov (speaking also for I.I. Zhilevich, A.A. Sukhiy, V.A. Gordeyeva, A.S. Pauzha and Yu. I. Kevalaytis) reported on the development of elctrophotographic reproducing equipment. A.S. Pauzha (speaking also for I.I. Zhilevich, A.S. Borisovich, N.M. Gal'viliks and M.I.Rautkauskas) reported on the use of electrographic methods in recording oscillographs and other recording instruments. V.P. Yurchenko (speaking also for L.N.Balin) spoke on the possibility of electrophotographically recording images from electron-beam tubes. L.S. Korol' (speaking also for N.N. Markevich, T.I. Kozlovskaya, B.I. Kalinauskene, M.K. Kaynens, I.I. Zhilevich and K.A. Montrimas) gave a detailed description of laboratory and machine methods of producing photosemiconductor papers (zinc oxide was used). A.A. Sukhiy (speaking also for I.I. Zhilevich, O.V. Gromov, V.A. Gordeyev, K.V. Fedotov and T.N. Ger) described a laboratory and industrial machine for producing photosemiconductor papers. T.A. Shishkina (speaking also for Ya.A. Ckman) reported on a method of examining electrophotographic materials using an a/c bridge. S.I. Khotyanovich (speaking also for A.I. Gikens and I.S. Shilevkens) spoke on developing materials for electrophotography and ferromagnitography, including developers giving a "reverse" image. B.I. Tikhonov reviewed methods of measuring the electrostatic potentials of electrophotographic layers, stressing that the oscillating electrode should not be placed above a layer with varying potential as this causes self-discharge. A.V. Krukovskis (speaking also for R.S.Sorevcy, A.I.Osipov and Ye. S. Kheyfets) spoke on the practice of producing velveteen papers in an electrostatic field, and showed samples produced by the Grigishkskaya paper factory. Ye.L. Nemirovskiy then gave a historical review of the development of electrographic methods in which he paid tribute to the work of the Scientific Research Institute of Electrography in Vil'nyus and the Institut poligraficheskogo mashinostroyeniya (Moskva)-(Polygraphic Machine-Building Institute (Moscow)). Debates were then held

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on methods of measuring the potential of charged electrophotographic layers, the vibration pick-up most-used was shown in B.I. Tikhonov's report to be not always accurate. S.G.Grenishin stated that the bad influence of the oscillating electrode can be eliminated if the electrode probe above its surface is fixed and the pick-up is connected to it by a shielded cable. In the debate on Ye.L. Nemirovskiy's report it was stated that the research of Academicians A.N. Terenin and Ye.K. Putseyko should be considered as the basis of all work on electrophotographic papers with ZnO, as they were the first to show the possibility of optical sensitization of the internal photoeffect in ZnO. N.L.Gol'vidis then gave a report on the depositing of charges by a corona discharge. A.I. Kaminskas and A.P. Yapulis reviewed some of the results of the use of electrographic methods in radiography. L.I. Nyun'ko (speaking also for I.I. Zhilevich, I.Z. Plavin, Yu.K. Vishchakas and Yu.A.Zibuts) reported on relaxation processes in semiconductor layers, using a vibration electrometer. Yu.K.Vishakas gave a report on research on some physical properties of the polycrystalline layers of selenious cadmium. M.P. Mikalkyavichyus spoke on some of the photoelectric properties of Sb_2S_3 and Sb_2Se_3: the absorption maximum of the latter is about 900 m μ. S.M. Neyman reported on methods of obtaining selenium light-sensitive layers, including sublimation and thermal treatment; it was also found that the sensitivity of the layers increased after storage for 1.5 to 2 months at room temperature. P.M. Podvigalkin (speaking also for S.G.Grenishin) spoke on research into the electrical properties of electrophotographic layers of amorphous selenium and powdered zinc oxide. N.K. Shiktorov (speaking also for A.S. Tauraytis) discussed the production of selenium layers and some of their properties. Finally the following reports on ferromagnetography were delivered; 1) B.Ya. Kaznacheyev, V.M.Zhogina, "Electrodeposition of Magneto-Hard Alloys with Given Magnetic Characteristics" 2) M.T.Arutyunov, "Visualization of Magnetic Oscillograms by the Ferrographic Method" 3) V.T.Patrunov, "Ferrographic Recording of Facsimile Images" 4) I.I.Zhilevich, I.I. Gikis, B. Ye. Buchek, I.I. Kavnise, A.K.Kirnis, "Mock Experiments in Non-Pressure Ferromagnetic Printing". There was also an exhibition showing the work of the Electrographic Institute. The most important conclusion of the conference was that a solid approach had been made to the possibility of wide technical use of the methods of electrography. It was considered that althouth work in this field actually started only in 1955-56 it has covered as much ground as the USA in 10 years. While admitting that it was easier to reproduce results already achieved than to be the first to arrive at them, the conference observed that the Americans took good care that no important information appeared in the literature available.

Card 10/10

AUTHORS: Zheludev, I.S. and Fridkin, V.M. 70-3-2-8/26

TITLE: On the Anisotropy of the Polarisation of Photoelectrets in Monocrystals of Sulphur (Ob anizotropii polyarizatsii fotoelektretov iz monokristallov sery)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 2, pp 182 - 185 (USSR).

ABSTRACT: The charges of photoelectrets produced in single crystals of sulphur by polarisation in different crystallographic directions have been measured. It was earlier assumed that these crystals were orthorhombic but they are now shown to have been monoclinic. The observed anisotropy in the polarisation of the photoelectrets is determined by the anisotropy in the photo-conduction of the single crystal of sulphur. The measurement of the charges of photoelectrets can serve as a very convenient method of studying the anisotropy of the photo-conductivity.

A cube, with edges about 6 mm, was cut from a single crystal of sulphur and polished. Superficially, the crystal was orthorhombic and the cube faces were cut perpendicular to the 2-fold axis. The faces 001 and $00\bar{1}$ were perpendicular to the acute bisectrix; 100 and $\bar{1}00$ were perpendicular to the obtuse bisectrix and 010 and $0\bar{1}0$ were parallel to the optic axial

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On the Anisotropy of the Polarisation of Photoelectrets in Monocrystals of Sulphur

plane. The cube was polarised for 10 minutes in a field of 700 V/cm and in an illumination of 10^{-4} W/cm^2. This was repeated in each of the 6 cube axis directions and the electret charges were measured by measuring the change in charge when, under continued illumination the electrets were de-polarised. The values found were (x 10^{-10} Coulomb/cm^2); 010, 95; 0$\bar{1}$0, 60; 100, 1.50; 1$\bar{0}$0, 1.47; 001, 44; 00$\bar{1}$, 20 . To eliminate the effects of cracks, the above measurements were repeated with three other specimens. To eliminate the effects of anisotropy in the light absorption the charges were re-measured with Nadjakoff's volume method (Izv. Bulg. Akad. Nauk., Ser.Fiz, Vol 2, pp 321-337, 1951). One of the specimens was placed between the plates of a condenser, one of the plates of which was fixed and connected to the needle of an electrometer and the other plate (the lower) was earthed and being movable could be lowered a known distance. As a result of the motion of the lower electrode with the electret the needle of the electrometer was deflected and the surface charge of the photoelectret could be measured. The condenser was constructed so that the specimen could be illuminated during polarisation in a direction

On the Anisotropy of the Polarisation of Photoelectrets in Monocrystals of Sulphur

perpendicular to that in which it was being polarised. Hence, for each direction of polarisation there were two independent directions in which the crystal could be illuminated. Specimens were polarised with 1.3 kV/cm for 10 min. with an illumination of 10^{-4} W/cm^2. The values for the charge density (in Coulombs x 10^{-10} per cm^2) were as follows: indices of illuminated face first, then direction of polarisation, then charge density) 001, 010, 28; 001, 0$\bar{1}$0, 18; 010, 010, 31; 010, 0$\bar{1}$0, 19; 001, 100, 40; 001, $\bar{1}$00, 38; 100, 100, 42; 100, $\bar{1}$00, 39; 100, 001, 12; 100, 00$\bar{1}$, 5; 010, 001, 12; 010, 00$\bar{1}$, 5. It is apparent that the charge density depends only on the direction of the polarising field and not on the density of the incident illumination. Hence, the anisotropy must be due to the anisotropy of photoconductivity. It is then found by Neumann's principle, that the crystal class must be m (monoclinic) with the plane of symmetry perpendicular to the obtuse bisectrix. Acknowledgments to Academician Shubnikov. There are 2 tables and 6 references, 5 of which are Soviet and 1 German.

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Inst Crystallography AS USSR

AUTHORS: Zheludev, I.S. and Fridkin, V.M. 70-3-3-10/36

TITLE: The Piezo-electric Effect in Photo-electrets (P'yezo-elektricheskiy effekt v fotoelektretakh)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 3, pp 315 - 321 (USSR).

ABSTRACT: Piezo-electric effects in photo-electrets have been detected and measured. The charges and the piezoelectric moduli of a photo-polarised crystal of anthracene have been measured and the decay of the charge and the d_{33} modulus during de-polarisation in the dark have been followed. The effects can be completely explained by the changes in the electric polarisation as a result of the changes in the geometrical dimensions of the specimen on mechanical strain. When the crystal becomes a photoelectret, its symmetry drops to become one of the sub-groups of $C_{\infty}.m$. The case of crystals of Class 2 is examined. Here, the piezo-electric moduli d_{14}, d_{15}, d_{24}, d_{25}, d_{31}, d_{32}, d_{33} and d_{36} are non-zero and relate the polarisation vector I_i to the strain tensor t_{ik}. s_{ik} are the elastic moduli and r_{ik} is the deformation tensor. S is the charge density on the surface of the photoelectret. For a cube polarised parallel to its X_3

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axis and distorted along the same axis $t_{33} \neq 0$, $I_3=d_{33}t_{33}$, $r_{11}=s_{13}t_{33}$, $r_{22}=s_{23}t_{33}$, $r_{33}=s_{33}t_{33}$ so that $d_{33}=S(s_{33}-s_{23}-s_{13})$. If $t_{11} \neq 0$ and $t_{22} \neq 0$ then $d_{31} = S(s_{13}-s_{11}-s_{12})$ and $d_{32}=S(s_{23}-s_{12}-s_{22})$. For a 10 mm cube of anthracene the values $d_{33} = 4.7 \times 10^{-9}$ e.s.u., $d_{31} = -2.5 \times 10^{-9}$ e.s.u., $d_{32} = -2.2 \times 10^{-9}$ e.s.u. and $S = 6 \times 10^{-7}$ coul./cm^2. Values for the elastic modulus s_{33} from measurements of the piezo-electric modulus d_{33} and from the known value of c_{33} agree to about 10%.

Acknowledgments to Academician A.V. Shubnikov.

There are 2 figures and 11 references, 6 of which are Soviet, 3 English, 1 French and 1 German.

ASSOCIATION: Institut kristallografii AN SSSR (Institute of Crystallography, Ac.Sc. USSR)

SUBMITTED: July 20, 1957.

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SOV/70-3-6-23/25

AUTHORS: Belyayev, L.M., Belikova, G.S., Fridkin, V.M. and Zheludev, I.S.

TITLE: On the Question of the Electret State in Naphthalene (K voprosu ob elektretnom sostoyanii v naftaline)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 6, pp 762-763 (USSR)

ABSTRACT: Baldus (Z. Angew.Phys., 1954, Vol 6, p 481) reported observing the transformation of hetero-charging in a naphthalene electret into homo-charging. This result contradicts other work and experiments were carried out to clarify the situation. Liquid naphthalene was allowed to set in an electric field between two Al plates 5 mm apart. The field of 4kV/cm was applied for 90 minutes. The naphthalene plate was removed from the condenser and tested with a dynamic electrometer. Heterocharging was found. Discharging by illumination was then tried. Integration of the discharge current gave an initial charge of 10^{-8} coulomb/cm^2. Repeated illumination gave no further discharge current. Hence the heterocharging is conditioned by localised electrons. Plates cut from single crystals of naphthalene were then tried. They were subjected to a field of 3 kV/cm for 10 min with U/V

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On the Question of the Electret State in Naphthalene

illumination. The charge density produced was about 10^{-10} coulomb/cm^2. A similar charge density could be produced by polarising in the dark. This shows that a sharp distinction cannot be drawn between the photoelectret and thermoelectret states in naphthalene and that both these phenomena are controlled by the same mechanism. There are 5 references, 2 of which are Soviet, 2 English and 1 German.

ASSOCIATION: Institut kristallografii AN SSSR (Institute of Crystallography of the Ac.Sc.USSR)

SUBMITTED: June 28, 1958

Card 2/2

AUTHORS: Zheludev, I. S., Fridkin, V. M. 48-22-3-28/30

TITLE: On the Photoelectret and Thermoelectret State in Sulfur Monocrystals (O fotoelektretnom i termoelektretnom sostoyaniyakh v monokristallakh sery)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya. 1958, Vol. 22, Nr 3, pp. 352-358 (USSR)

ABSTRACT: The authors investigated the dependence of the charge of the photoelectret on the conditions of its polarization as well as the duration of existence of the residual polarization in the monocrystals of sulfur. They investigated the dependence of the depolarization velocity on the temperature and introduced the conception of a thermoelectret state. The duration of existence of the inner polarization was investigated in the monocrystalline and polycrystalline sulfur. A depolarization ought to be carried out after a sufficiently long period for the determination of the amount of photopolarization of the polycrystalline sulfur with a short-time illumination during the polarization process (ref. 2). The dark polarization disappears completely during this period and the photopolarization is preserved. Nevertheless, this method seems to

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be unfit with the polarization of the sulfur crystals since the total residual polarization drops to zero in this case. From the comparison of the curves (figs. 4 and 2) it may be concluded that the law of mutual substitution in the crystal is not complied with with the formation of an inner polarization. This signifies that with one and the same E.τ--value the amount of the residual polarization depends on the duration of illumination. The velocity of depolarization of the sulfur-monocrystal was investigated at different temperatures. The depolarization-curves of the photoelectret which were determined, are analogous to the depolarization curves of the thermo-electrets in the case of simultaneous illumination and heating (e.g. ref. 5). The photoelectret state of the sample is also thermoelectret at the same time under the conditions described, since the illumination of the photoelectret at low temperatures leads only to a partial discharge. A complete depolarization only takes place at an increase in t temperature up to the temperature prevailing at its polarization. This state of the sulfur-sample is at the same time also thermoelectret, since a simultaneous

heating and illumination is required for the complete depolarization. This state can consequently be denoted as thermo--photo-electret. The thermo-photo-electret state in the sulfur--monocrystal is apparently caused on the one hand by the fastening of the ions on some local levels and on the other hand by the presence of a thermal barrier. This barrier separates the level of excitation from the zone of conductivity. The mechanism which was proposed for the explanation of the temperature-dependence of the photo-conductivity in alkaline--halogen crystals (ref. 7), is apparently able to explain the thermo-photoelectret effect and consequently also the formation of the maximum of transition of the discharge--current during the depolarization process of the photoelectrets with simultaneous illumination and heating. The authors thank A. V. Shubnikov, Member, Academy of Sciences, and G. Nazhdakov, Member of the Bulgarian Academy of Sciences for the discussion of the work-results as well as Yu. N. Martyshev and A. I. Delovaya for their assistance in carrying out the measurements. There are 5 figures and 7 references, 4 of which are Soviet.

Fridkin, V.M.

20-2-18/60

AUTHOR: Fridkin, V. M.

TITLE: Photoelectrets and the Formation of a Latent Electro-Photographic Image (Fotoelektrety i obrazovaniye skrytogo elektrofotograficheskogo izobrazheniya)

PERIODICAL: Doklady AN SSSR, 1958, Vol. 118, Nr 2, pp. 273 - 276 (USSR)

ABSTRACT: First there is a short report on previous studies, dealing with the same subject. This work brings some new results, which were obtained at examining the photoelectret-state by the electrophotographic method. The method described in a previous work (reference 6) by the author is based upon the following: On an aluminum plate in vacuum $\sim 50\,\mu$ thick layers of poly-crystalline sulphur were dusted. Those layers were during an application of voltage and uninterrupted illumination, polarized through across a semi-transparent electrode. Upon the surface of the photoelectret the positive image was projected. On that occasion the illuminated parts of the photoelectret were depolarized but the points, which were not illuminated kept their initial polarization. The latent image, which re-

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sults in the case of exposure can reproduce the original in half-tone. For developping the latent image the tribo-electric effect was used. For this, asphalt powder was mixed with fine pulverized common-salt crystals. On this occasion the salt particles got positive charge and the asphalt particles negative one. The mixture of both powders was spread upon the surface of the photoelectret with the latent image, and according to the charge on the surface of the photoelectret, the latent image was developed by the salt particles and by the asphalt particles. The author examined the connection between the magnitude of the surface-charge of the photoelectrets and the optical density of the developed image. As electrode for polarization glass with a dusted layer of silver was used. The here ascertained dependence of the optical density on the field-strength of the surface of the photoelectret is linear, and upon this dependence the author based the electro-photographic or sensitometric method for examining the photoelectretic state in mono-crystalline and poly-crystalline test-pieces. Especially the duration of conservation of the photo-polarization in a photoelectret of poly-crystalline sulphur was examined in this way. The

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author also examined the regression of the latent electrophotographic image in the case of a photoelectret and also in the case of adsorption of ions at the surface of a dielectric with photoconduction. The results, got here, prove that the latent electrophotographic image on the poly-crystalline photoelectret is conditioned by the fastening of the electrons to the low local levels which form at the boundaries of the crystal grains. There are 4 figures, and 7 references, 6 of which are Slavic.

ASSOCIATION: Institute for Crystallography of the AN USSR
(Institut kristallografii Akademii nauk SSSR)

PRESENTED: May 18, 1957, by A. V. Shubnikov, Academician

SUBMITTED: May 14, 1957

23(3), 24(2) SOV/20-121-4-15/54

AUTHOR: Fridkin, V. M.

TITLE: The Theory of the Formation of a Latent Electrophotographic Image and the Law of Interchangeability (Teoriya obrazovaniya skrytogo elektrofotograficheskogo izobrazheniya i zakon vzaimozamestimosti)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 121, Nr 4, pp 627-630 (USSR)

ABSTRACT: The kinetics of the formation of the photoelectret state in monocrystals and the depolarization of the photoelectrets under the influence of light may be investigated on the basis of the zone theory of the crystals. With the conceptions of this zone theory it is possible to develop a general theory of the formation of a latent electrophotographic image and this theory may also be applied to other processes, for example, to classical xerography and to classical electrophotography. Such an investigation consists essentially in the solution of a system of differential equations which describes the electron transitions according to a zone model. This zone model corresponds to the scheme of the energy levels

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of the electrons of the investigated crystal. The author uses the scheme of P. S. Tartakovskiy and G. Rekalova (Ref 4) of the electron levels in a monocrystal of sulphur. First, the kinetic equations are given which describe the filling of the "adhesion levels" (uroven' prilipaniya) by electrons. One has to find the dependence of the concentration N of the electrons on these "adhesion levels" on time. The orient.. ing influence of the polarizing field is not taken into account. The quasisteady solution of the above-mentioned system satisfactorily describes the formation of the photoelectret state in a monocrystal and it may be used as a basis of the theory of the formation of the latent electrophotographic image. This paper proves the following law: The validity of the interchangeability law is a necessary and sufficient condition for the correctness of the quasisteady solution. If applied to an electrophotographic process, this interchangeability law is of immediate physical significance and for the formation of a photoelectret state in monocrystals it can be formulated as follows: The value of the polarization or the value of the surface density of the photoelectret

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charges (which is proportional to the density N of the electrons on the adhesion levels) depends only on the product Et of the intensity E of the polarizing light and of the polarization time t. The existence of a low quasisteady concentration of conduction electrons is a sufficient condition for the validity of the law of interchangeability. Any quasisteady solution of the initially mentioned system of equations satisfies the interchangeability law and, inversely, any solution of this system which satisfies the interchangeability law is a quasisteady solution. The interchangeability law has to be considered as a dependence of the optical density of the developed electrophotographic image only on the product Et. The author thanks A. V. Shubnikov, Academician, and I. S. Zheludev for the supervision of these investigations and Professor E. I. Adirovich for some useful remarks. There are 1 figure and 5 references, 5 of which are Soviet.

Inst. Crystallography AS USSR

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S/123/61/000/022/021/024
A004/A101

6.1360 (1138)

AUTHOR: Fridkin, V.M.

TITLE: High-sensitive electrophotographic layers and electrophotographic printer

PERIODICAL: Referativnyy zhurnal. Mashinostroyeniye, no. 22, 1961, 22, abstract 22Zh202 (V sb. "Elektrofotogr. i magnitofotografiya", Vil'nyus, 1959, 33 - 43, Lithuanian summary)

TEXT: The author determines the value of the integrated sensitivity of electrophotographic layers for processes based on the polarization and depolarization of crystals - photoelectrets in the form of magnitudes which are reciprocal to the relaxation period measured at an illumination of 1,000 lux. The author analyzes the criteria of sensitivity of the process of the so-called classic electrophotography, based on the surface charge of the dielectric layer possessing a photoconductivity, a corona discharge in the air. The author presents the results of experimental investigations of electrophotographic layers from ZnO and an electrosensitometer diagram. The electrification of the layers was carried out by a pointed tool at a distance of 10 mm from the surface and a

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voltage of 6 kv. The image was developed with a colloidal solution of printer's ink in benzene, the positive particles of which were deposited on the latent image in the form of a definite distribution of negative charges. The investigation results have been taken into consideration in the electrophotographic copying apparatus developed by NIIPoligrafmash for copying facsimile and half-tone originals (diapositives, tracings, texts, etc.) on electrophotographic paper. There are 9 figures and 13 references.

G. Flidlider

[Abstracter's note: Complete translation]

Card 2/2

SOV/77-4-1-4/22

AUTHORS: Anfilov, I.V., and Fridkin, V.M.

TITLE: The Theory of the Development of the Latent Electrophotographic Image (K teorii proyavleniya skrytogo elektrofotograficheskogo izobrazheniya)

PERIODICAL: Zhurnal nauchnoy i prikladnoy fotografii i kinematografii, 1959, Vol 4, Nr 1, pp 32-34 (USSR)

ABSTRACT: The authors devide former theories of the development of the latent electrophotographic image into two groups: 1) the "dry-development method", 2) the "wet method." The authors hold that the phenomenon behind the development of the latent electrophotographic image is a recombination of electric charges and present mathematical formulae to support their opinion. They conclude that the full development of all parts of the latent image, which carry a different charge with respect to density, occurs simultaneously (the simultaneous development of all half-tones of the latent electrophoto-

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graphic image). The authors admit that the results of experimental investigations are not contrary to the possibility of a formation of double electrical layers. There are 5 references, 2 of which are American and 3 Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy institut poligraficheskogo mashinostroyeniya (The Scientific Research Institute of Polygraphic Machine Building)

SUBMITTED: March 28, 1958

.23(5) SOV/77-4-2--2/18

AUTHOR: Fridkin, V.M.

TITLE: The Formation of a Latent Electro-Photographic Image Depending on the Depolarization of the Photo-Electret (Obrazovaniye skrytogo elektrofotograficheskogo izobrazheniya, obuslovlennoye depolyarizatsiyey fotoelektreta)

PERIODICAL: Zhurnal nauchnoy i prikladnoy fotografii i kinematografii, 1959, Vol 4, Nr 2, pp 90-93 (USSR)

ABSTRACT: In his introduction, the author says that the formation of a latent electro-photographic image on a photo-electret can be caused both by polarization of the corresponding dielectric and by depolarization of the photo-electret when illuminated [Ref. 1]. The case of polarization corresponding to the electro-photographic negative-positive system was examined in detail in other works [Refs. 2,3]. The mechanics of the process

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of depolarization of the photo-electret when illuminated has also been examined [Refs. 4,5]. Tartakovskiy carried out a detailed investigation of the latter process in respect of sulphur monocrystals and alkali-halide crystals dyed with additives [Refs. 6,7]. On the basis of these investigations, it was propounded that the process of depolarization was caused by the transfer of electrons under the effect of light into conductivity zone from the basic zone and from the local or adhesion levels, and by the movement of the conduction electrons under the effect of the inner field of the photo-electret until total destruction of the polarization takes place [Ref. 6]. The mechanics of this depolarization can be used as a basis for calculations using the kinetics of electronic migrations in the zone model of a crystal. In works [Refs. 2,3] examining the formation of the photo-electret condition in a sulphur monocrystal

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the author and his colleagues proceeded from the system of equations (1,2,3,4,5) describing the kinetics of the electronic migrations, to the system of the electron energy levels in a sulphur monocrystal proposed by Tartakovskiy and Rekalova [Ref. 6]. The author then examines the two processes which lie at the basis of photo-electret depolarization when illuminated; the freeing of electrons from the adhesion levels and their simultaneous recombination with the basic zone perforations, and secondly the creation of inversely directed polarization caused by the inner field of the photo-electret and the conduction electrons, whose density may be considered to be quasi-stationary. The mechanics of the depolarization of the photo-electret caused by the first process is analagous to the case when a certain law of afterglow of the crystal phosphurus takes

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place [Ref. 8]. This process may be described by equations 2, 6 and 7. Examination of the second process has shown that the relationship between the charge of the photo-electret and the time taken in depolarization is not subject to the simple exponential law and in the first approximation can be presented as the sum of two exponents with relaxation periods $\tau=1/k$ and 2τ . Experiments were carried out on depolarization of sulphur monocrystals in which a photo-electret condition was first produced. The results of measurements of the depolarization current, observed during the illumination of the polarized crystals by light of varying intensity is given in Figure 1; in Figure 2 they are given as the relationship between $\ln\frac{i}{E}$ and $\ln Et$ where $i=\frac{dp}{dt}$ representing the amplitude of the discharge current, observed at a given moment of time t and E is the intensity of

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the light used during depolarization. The results in Figure 2 show that during changes in the intensity of light over almost the entire range given, the law of interchangeability applies. However, the results also show that the depolarization current i=dp/dt was not subject to exponential dependence the entire time measurements were made, thus: $\frac{dp}{d\tau} = -\frac{p_0}{\tau} e^{-\frac{\tau}{\tau}}$ where $\tau = \frac{1}{K}$, which follows immediately from equation 6. The author says that as the law of interchangeability is observed in the depolarization of photo-electrets (the measurements being made on sulphur monocrystals), it is possible to conclude that this law characterizes the electrophotographic process as a whole, regardless of whether it is caused by the polarization of the sulphur crystals or their depolarization during illu-

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mination. Finally, the author conveys his deep gratitude to A.V. Shubnikov and I.S. Zheludev for their attention to this work. There are 2 graphs and 8 Soviet references.

ASSOCIATION: Institut kristallografii Akademii nauk SSSR (Institute of Crystallography of the AS USSR)

SUBMITTED: April 2, 1958

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23(

SOV/77-4-3-6/16

AUTHOR: Fridkin, V.M.

TITLE: Characteristic Curves of the Electrophotographic Process and the Sensitivity of Electrophotographic Layers

PERIODICAL: Zhurnal nauchnoy i prikladnoy fotografii i kinematografii, 1959, Vol 4, Nr 3, pp 198-201 (USSR)

ABSTRACT: This is a summary of the results of a number of previous investigations of the author [references 1-4], intended to clarify the role of photoelectrets in electrophotographic processes. The author gives a number of curves which generalize the relations between certain magnitudes (optical density of the electrophotographic layer, density of charge, relaxation time of charge, sensitivity of the electrophotographic layer, exposure) of electrophotographic polarization and depolarization processes. Polarization is the basis of the process of transition from the

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negative to the positive image. Depolarization of the photoelectret during exposure is characteristic of the second process (positive-positive) of electrophotographic latent image formation. For either of these processes, the author has established a curve ($D=Ds(1-e^{\frac{-s2Et}{1-\gamma}})$; $D_s=k'\gamma M$ and $D=D_s e^{-s2Et}$), which expresses the relations between the optical density of the latent image and the charge of the layer. The latter depends on the times of exposure during polarization or depolarization. The sensitivity of the electrophotographic layer during polarization can be directly determined from the characteristic curve (2). As this curve has an exponential character, the relaxation time of the charge (identical with the relaxation time of optical density) can serve as a criterium

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of sensitivity in the case the initial section of the curve (short exposures and low optical densities) alone is considered. Equation $\left[\tau = \frac{1-f}{s_2 E}\right]$ shows that the criterium of sensitivity depends on the properties of the layer (magnitudes s_2 and f) as well as on illumination E. The inverse form of the equation is $\omega = \frac{1}{\tau} = \frac{s_2 E}{1-f}$, ω is the sensitivity of the electrophotographic layer in $sec.^{-1}$, E the illumination. This determination of electrophotographic sensitivity can be extended on the process, which is connected with the depolarization of the photoelectret. In a former work [reference 1] the author

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pointed to the close relationship between photoelectret depolarization and classical electrophotography, which is based on ion adsorption on the surface of the layer and following depolarization. Curve 5 (see above) fully corresponds to the experimental results of work devoted to the study of the characteristic curves of the processes of classical xerography and classical electrophotography [references 5 and 6-7]. The sensitivity equation is the same as for the polarization process, if $\gamma \ll 1$ (an explanation of this magnitude can be found in the article in connection with curve 2). At the end of the article, the author has inserted a table with the ω -values of some layers (S - 0.01; ZnO - 0.1; Se - 10), which were already used in electrophotographic laboratory work. The author expresses his gratitude for the aid of the scientists Academician A.V.Shubnikov and I.S.Zheludev. There are

SOV/77-4-3-6/16

Characteristic Curves of the Electrophotographic Process and the Sensitivity of Electrophotographic Layers

1 table and 6 references, 5 of which are Soviet and 1 English.

ASSOCIATION: Institut kristallografii Akademii nauk SSSR (Institute of Crystallography of the AS USSR)

SUBMITTED: April 2, 1958.

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FRIDKIN, V. M.

24 (3)

AUTHORS: Golovin, B. M., Kashukeyev, N. T., SOV/20-128-1-15/58
Fridkin, V. M.

TITLE: The Role of the Field in the Formation of the Heterogeneous Charge of a Photoelectret

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 128, Nr 1, pp 63 - 66 (USSR)

ABSTRACT: The authors consider the role played by the field in the formation of the photoelectret state in a single crystal by substituting a term into the equations (1), (2), (3), of a previous paper by V. M. Fridkin (Ref 2). The term takes the current divergence into account. Thus, the following set of nonlinear equations is obtained which consider the variation with time of the electron density n within the range of conductivity, of the electron density N on the adhesion levels, and of the concentration P of the holes in the basic range when the crystal is illuminated and the field is applied:

$$\partial n/\partial t = d_1 + kN - \alpha nP - \beta n(M - N) - \partial(nu_1\mathcal{E} - D_1\partial n/dx)/dx$$

$$\partial N/\partial t = - kN + \beta n(M - N); \quad \partial P/\partial t = d_1 - \alpha nP - \partial(Pu_2\mathcal{E} - D_2\partial P/\partial x)/\partial x$$

Instead of the neutrality condition $P = N + n$ a conservation

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condition of the form $\int_0^l P dx = \int_0^l (N + n) dx$ is to be complied with. It is to be integrated over the crystal length in the direction of the applied field. In the above equations it holds: $d_1 = s_1 E$ and $k = s_2 E$, where E denotes light intensity. $\mathcal{E}$ denotes the electric field strength, u_1 and u_2 the mobility of the conductivity electron and the hole in the basic range, D_1 and D_2 the diffusion coefficients of electrons and holes. Additionally, the relations $\mathcal{E} = \mathcal{E}_1 - \mathcal{E}_0$, $\frac{\partial \mathcal{E}_1}{\partial x} = \frac{4\pi e}{\epsilon}(P-N-n)$ hold in this connection. The expression for the photoelectret charge $\sigma = (P-N-n)e$ may be obtained by the solution of the set of equations written down at the beginning. It depends on the time t and the coordinate x. The afore-mentioned set of equations is then transformed. Part I of this article deals with the validity of the law of exchangeability of the two possible processes of photoelectret formation as defined by the two above

sets. This law means that the photoelectret charge depends everywhere only on the strength of exposure $z = Et$: $\sigma = P - N - n = \sigma(z,x)$ for $0 < x < l$. A necessary condition for the validity of this law is the validity of the condition $n = n_0(z,x)E$. The conclusions drawn in this article allow for an interpretation of certain results of experiments on the establishment of the photoelectret state in anthracene single crystals. In Part II, the authors apply the transformed set of equations to the case in which the field $\mathcal{E}_1$ of space charges may be neglected with respect to the outer field $\mathcal{E}_0$. The authors thank G. Nadzhakov, Academician of the Bulgarian Academy of Sciences, Academician A. V. Shubnikov, and Professor V. P. Dzhelepov for their interest in the present article. There are 5 Soviet references.

The Role of the Field in the Formation of the Heterogeneous Charge of a Photoelectret SOV/20-128-1-15/58

ASSOCIATION: Institut kristallografii Akademii nauk SSSR (Institute of Crystallography of the Academy of Sciences, USSR). Institut fiziki Bolgarskoy Akademii nauk (Institute of Physics of the Bulgarian Academy of Sciences). Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

PRESENTED: May 6, 1959, by A. V. Shubnikov, Academician

SUBMITTED: May 4, 1959

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24.3500
~~24 (3)~~

SOV/20-129-4-16/68

AUTHOR: Fridkin, V. M.

TITLE: The Photoelectret State and Luminescence Afterglow in ZnS

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 4, pp 773 - 776 (USSR)

ABSTRACT: In an earlier paper the author suggested solving the problem of the excitation of an ideal crystal phosphor by light in the case of a lacking electric field under the conditions of the quasi-steady approximation by E. I. Adirovich (Ref 2). In this paper it is assumed that the quantity $N \sim P$, which is proportional to the light sum, is at the same time also proportional to the photoelectret charge. The author carried out a parallel investigation of the photoelectret state and of the luminescence afterglow in polycrystalline ZnS activated with Cu and Cl. For this purpose the light sum accumulated in the sample during its excitation by light in the case of a lacking field and the photoelectret charge occurring in the same sample under the same excitation conditions were measured simultaneously. The photoelectret charge was investigated by means of a tube electrometer according to the method developed by G. Nadzhakov and N. T. Kashukeyev. The light sum was measured by means of a photo-

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multiplier of the type FU-19. The order of measurements is given. The first diagram shows the results obtained by measuring the photoelectret charge from ZnS as a function of the radiant energy Et incident upon the sample during polarization. The second diagram shows the results obtained by measuring the light sum accumulated in ZnS during excitation in the case of a lacking field as a function of the radiant energy Et incident upon the sample during excitation. Each of these curves show a saturation which is due to different mechanisms. Whereas the production of the photoelectret state in ZnS is due to the validity of an interaction law, sharp deviations from this law are characteristic of the dependence of the light sum on the excitation energy, i.e. the light sum depends not only on Et. During accumulation of the light sum in ZnS the least "low" levels of "adhesion" play the main part, whereas the production of a stable "photoelectret state" in ZnS is characterized by localization of the electrons on the lowest levels of adhesion (which correspond to an activation energy $U > kT$). A formula for the dependence of the light sum S on the excitation time t is written down. The parallel investigation of the photoelectret state and

The Photoelectret State and Luminescence Afterglow in ZnS SOV/20-129-4-16/68

of the luminescence afterglow show the specific part played by the three groups of "adhesion" levels. The first group of these levels (i.e. the lowest) cause the production of a stable photoelectret state in the dielectric. The second group causes the dark polarization of the dielectric, and the lowest group (whose levels are the least low) cause the luminescence afterglow. The author is then said to thank Academician A. V. Shubnikov for his interest in the present paper, E. I. Adirovich, Doctor of Physical and Mathematical Sciences, for some valuable advice, and I. S. Zheludev for discussing the paper. There are 2 figures and 6 Soviet references.

ASSOCIATION: Institut kristallografii Akademii nauk SSSR (Institute of Crystallography of the Academy of Sciences, USSR)

PRESENTED: July 15, 1959, by A. V. Shubnikov, Academician

SUBMITTED: July 9, 1959

24.2600
~~24 (3), 23 (3)~~

77307
SOV/20-129-5-13/64

AUTHORS: Golorin, B. M., Zheludev, I. S., Kashukeyev, N. T., Orlov, I. N., Fridkin, V. M., Mogilevskaya, L. Ya., [illegible] A. S.

TITLE: A New Electrophotographic Process Which May Be Realized by Means of Combined Electret Layers

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 5, pp 1008-1011 (USSR)

ABSTRACT: The present paper deals with a new electrophotographic process in which combined electret layers are used in addition to "memory properties". In 1955 Fridkin et al. (Ref 8) described electric photography by means of pho oelectrets on the basis of the constant internal photoelectric polarization in dielectrics discovered by G. Nadzhakov (Ref 9). A layer of a photoelectric conductor with relatively high photosensitivity and relatively low inertia is applied to the semi-transparent electrode. The dark resistance of this layer may be very low. Onto the layer of the photoelectric conductor, a layer of a dielectric with stable dark-polarization is applied. The adjoint second electrode may then be opaque. The electrophotographic process is then realized as follows: A constant voltage is

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applied to the two electrodes. With $R_2 \gg R_3$ (R_2 dark resistance of the photoelectric conductor, R_3 - dark resistance of the dielectric) the voltage meeting the layer of the dielectric practically equals zero. Through the semi-transparent electrode an image is projected on to the surface of the photoelectric conductor. As a result of the internal photoelectric effect in the photoelectric conductor, the voltage in the corresponding exposed parts of the photoelectric conductor changes, and a stable electret state is then produced in the dielectric. The latent electrophotographic image may then be "read" by means of an electron beam. Ferroelectrics and thermoelectrets may be used as dielectrics. The characteristic curve of the combined electret layers may be determined by analyzing the kinetics of the photoelectric conductivity of the photoelectric conductor and of electret state formation. A law of mutual exchangeability of electrets is satisfied if the charge of the electret is a function of

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$\int_0^{\tau} E\,dt$ alone, where E denotes the field strength of the polarizing field and τ - the duration of polarization. The authors experimented with combined electret layers, in which cadmium sulfide (activated with copper and chlorine) were used as photoelectric conductors, and zinc sulfide (also activated with copper and chlorine) served as electret. A diagram shows the dependence of the charge of the ZnS-electret on the field strength of the polarizing field. In the interval under investigation this dependence is linear. The law of reciprocal exchangeability does not apply in the case of the combined electret layers investigated here. The authors thank Academician A. V. Shubnikov and Academician G. S. Nadzhakov for discussing the results obtained by the present paper. There are 3 figures and 17 references, 13 of which are Soviet.

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ASSOCIATION: Institut kristallografii Akademii nauk SSSR (Institute of Crystallography of the Academy of Sciences of the USSR). Institut fiziki Bolgarskoy Akademii nauk (Institute of Physics of the Bulgarian Academy of Sciences). Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

PRESENTED: July 15, 1959, by A. V. Shubnikov, Academician

SUBMITTED: July 9, 1959

PHASE I BOOK EXPLOITATION SOV/4485

Fridkin, Vladimir Mikhaylovich and Ivan Stepanovich Zheludev

Fotoelektrety i elektrofotograficheskiy protsess (Photoelectrets and the Electrophotographic Process) Moscow, Izd-vo AN SSSR, 1960. 205 p. Errata slip inserted. 5,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut kristallografii.

Resp. Ed.: G. S. Nadzhakov, Academician, Bulgarian Academy of Sciences; Ed. of Publishing House: V. I. Rydnik; Tech. Ed.: L. A. Lebedeva.

PURPOSE: This book is intended for scientists working in the field of electrets.

COVERAGE: The book is described as the first serious attempt at a systematic presentation of the results of investigations carried out from 1955 to 1959 in the field of photoelectrets by the Laboratoriya elektricheskikh svoystv kristallov Instituta kristallografii AN SSSR (Laboratory of the Electrical Properties of Crystals of the Institute of Crystallography, Academy of Sciences USSR) and the Fizicheskaya laboratoriya Nauchno-issle-

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dovatel'skogo instituta poligraficheskogo mashinostroyeniya (Physics Laboratory of the Scientific Research Institute of Printing Machinery). The authors also include work done by the Institute of Crystallography, Academy of Sciences USSR, the Physics Institute of the Bulgarian Academy of Sciences, and the Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research) on photoelectrets and the possibilities of their utilization. All this material has been published in the periodical literature. Ch. I surveys problems of thermoelectret research. Ch. II deals mainly with photoelectrets. Ch. III is devoted to the electrophotographic process with emphasis on electrophotography on photoelectrets. In this chapter the authors confine themselves to a brief description of the fundamentals of the electrophotographic process and try to demonstrate that this phenomenon makes possible a convenient approach to investigations on the formation of the hidden electrophotographic image. The authors thank N. T. Kashtkeyev, Senior Scientific Worker of the Physics Institute, Bulgarian Academy of Sciences; B. M. Golovin and L. M. Belyayev, Candidates of Physics and Mathematics; E. I. Adirovich, Doctor of Physics and Mathematics; G. Nadzhakov, Academician, Bulgarian Academy of Sciences (Sofia), editor of the book; A. V. Shubnikov, Academician; A. I. Dalova; L. Ya. Mogilevskaya; and L. V. Duda. There are 136 references: 74 Soviet, 46 English, 14 German, and 2 Bulgarian.

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27998
S/194/61/000/004/041/052
D201/D302

24,2600 (1137, 1138, 1160)

AUTHORS: Zheludev, I.S. and Fridkin, V.M.

TITLE: Photoelectrets and electrophotography

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 4, 1961, 2, abstract 4 E9 (Fizika dielektrikov, M., AN SSSR, 1960, 139-149 Discussion, 164-169)

TEXT: The formation of residual polarization under the action of illumination in a monocrystal corresponds to the formation in it of a photoelectretic state. The original symmetry of physical properties of the crystal is destroyed with it. Owing to internal polarization there is no center of polarization in photoelectrets (E) (F), and they may then be referred to as piezoelectric materials. The piezoelectric polarization may be induced either by the past or present special polarizing force due to mechanical stress. A linear dependence exists between the piezoelectric and elasticity properties of F, the piezoelectric moduli being proportional to the

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Photoelectrets and electrophotography

polarization of F. The polarization of crystals, measurement of thus formed electric charge in F and the measurement of piezoelectric moduli, all above may be done using a special network. A cube of anthracene crystal is placed between the electrodes, its illumination being perpendicular to the direction of polarization. The value of the modulus of elasticity may be obtained in approximation from the charge density and piezoelectric moduli for F has been experimentally confirmed. Both the piezoelectric modulus and change of F decrease with time according to approximately the same law. F exhibit the pyro-electric effect, i.e. the change with temperature of the internal polarization. With increasing temperature the photopolarization of crystals sharply decreases. F may be used for electrophotography. The formation of a photoelectric picture on F is explained by the process of polarization and of depolarization with repeated illumination. A diapositive is placed at the surface of a previously polarized F and the surface is illuminated again through the diapositive. The illuminated regions are depolarized while the regions covered by the picture elements remain polarized,

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Photoelectrets and electrophotography

thus forming a hidden picture. To reproduce this hidden picture the tribo-electric effect is used. The respective components of the tribo-electric mixture are charged +ve and -ve and sprinkled over the surface of F, at which they are retained only at spots where the polarization has been retained. The F with a paper sheet on it is placed in the field of a corona discharge. The positively charged particles are transferred to the paper and form a picture. The method corresponds to the positive-positive method. F with short circuited plates may be stored in darkness for a considerable time, although with time the intensity of the hidden picture decreases slightly. 25 references. [Abstracter's note: Complete translation]

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FRIDKIN, V. M.

PHASE I BOOK EXPLOITATION SOV/4379

Vsesoyuznaya konferentsiya po fizike dielektrikov. 2d, 1958

Fizika dielektrikov; trudy vtoroy vsesoyuznoy konferentsii (Physics of Dielectrics; Transactions of the 2d All-Union Conference on the Physics of Dielectrics) Moscow, Izd-vo AN SSSR, 1960. 532 p. Errata slip inserted. 5,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Fizicheskiy institut imeni P.N. Lebedeva.

Ed. of Publishing House: Ye.L. Starokadomskaya; Tech. Ed.: I.N. Dorokhina; Editorial Board: (Resp. Ed.) G.I. Skanavi, Doctor of Physics and Mathematics (Deceased), and K.V. Filippova, Candidate of Physics and Mathematics.

PURPOSE: This collection of reports is intended for scientists investigating the physics of dielectrics.

COVERAGE: The Second All-Union Conference on the Physics of Dielectrics held in Moscow at the Fizicheskiy institut imeni P.N. Lebedeva (Physics Institute imeni P.N. Lebedev) in November 1958 was attended by representatives of the principal scientific centers of the USSR and of several other countries. This collection contains most of the reports presented at the conference and summaries of the discussions which followed. The reports in this collection deal with dielectric properties, losses, and polarization, and with specific inductive capacitance of various crystals, chemical compounds, and ceramics. Photoelectrets, ferroelectric crystals, and various radiation and irradiation effects on dielectrics are investigated. The volume contains a list of other papers presented at the conference dealing with polarization, losses, and breakdowns of dielectrics, which were published in the journal Izvestiya AN SSSR, seriya fizicheskaya, Nos. and 2 1960. No personalities are mentioned. References accompany each report.

FRIDKIN, V. M.

Vsesoyuznaya konferentsiya po fizike dielektrikov. 2d 1958

Fizika dielektrikov, trudy vtoroy vsesoyuznoy konferentsii (Physics of Dielectrics, Transactions of the 2d All-Union Conference on the Physics of Dielectrics) Moscow, Izd-vo AN SSSR, 1960. 532 p. Errata slip inserted. 5,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Fizicheskiy institut imeni P.N. Lebedeva.

Ed. of Publishing House: Ye.L. Starokadomskaya, Tech. Ed.: I.N. Dorokhina; Editorial Board: (Resp. Ed.) G.I. Skanavi, Doctor of Physics and Mathematics (Deceased), and K.V. Filippova, Candidate of Physics and Mathematics.

PURPOSE: This collection of reports is intended for scientists investigating the physics of dielectrics.

COVERAGE: The Second All-Union Conference on the Physics of Dielectrics held in Moscow at the Fizicheskiy institut imeni P.N. Lebedeva (Physics Institute imeni P.N. Lebedev) in November 1958 was attended by representatives of the principal scientific centers of the USSR and of several other countries. This collection contains most of the reports presented at the conference and summaries of the discussions which followed. The reports in this collection deal with dielectric properties, losses, and polarization, and with specific inductive capacitance of various crystals, chemical compounds, and ceramics. Photo-electrets, ferroelectric crystals, and various radiation and irradiation effects on dielectrics are investigated. The volume contains a list of other papers presented at the conference dealing with polarization, losses, and breakdowns of dielectrics, which were published in the journal Izvestiya AN SSSR, seriya fizicheskaya, No. 1 and 2, 1960. No personalities are mentioned. References accompany each report.

81893

S/181/60/002/05/37/041
B004/B056

24.7700

AUTHORS: Golovin, B. M., Kashukeyev, N. T., Orlov, I. N., Fridkin, V. M.

TITLE: The Photoelectric State in ZnS and Two New Electrophotographic Processes

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 5, pp. 1004 - 1010

TEXT: The authors investigated polycrystalline ZnS which had been activated by Cu and Cl, and which showed electroluminescence. A voltage of 300 v was applied to the samples which were shaped in the form of tablets and bound with polystyrene. This was followed by ultraviolet irradiation (320-500 mμ) of varying duration by means of a VRK-4 (PRK-4) lamp. The experimental apparatus and the measuring techniques are described in Ref. 1. Measurements were carried out of the short-circuit current of the photoelectret and its depolarization by repeated exposure. Fig. 1 shows the decrease of the dark polarization at 300 v, which was at first rapid and then slow, of photopolarization, and of total polarization. The course taken by the curves is explained by localization of

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the electrons on low energy levels. Fig. 2 shows the dependence of polarization on the field voltage, and Fig. 3 the dependence of the charging of ZnS on the radiation energy. With a maximum radiation energy of 400.10^{-6} w/cm^2 an exposure of 2.10^{-3} sec is sufficient to cause a noticeable photopolarization. As may be seen from Fig. 4, the dependence of photopolarization on the time of exposure does not follow an exponential law. Further experiments were carried out with ZnS, which was first exposed and then charged (Fig. 6). Also in this case, the law of interchangeability is maintained, but, as shown in Fig. 7, there is no exponential dependence. The authors produced electrophotographic layers from ZnS + ZnO (description in Ref. 7), which were exposed to the light of a mercury lamp through a negative. After polarization in the capacitor, the image could be made visible by means of an electrophotographic developer (Ref. 7). Electroluminescence is effected by depolarization in an alternating-current field, whereby the image becomes visible on the ZnS + ZnO layer. A. I. Delova and L. Ya. Mogilevskaya took part in the experiments. The authors thank Academician A. V. Shubnikov, Academician G. Nadzhakov, and Professor V.P. Dzhelepov

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The Photoelectric State in ZnS and Two New Electrophotographic Processes

S/181/60/002/05/37/041
B004/B056

for their interest in this investigation. There are 7 figures and 7 references: 6 Soviet and 1 British.

ASSOCIATION: Institut kristallografii AN SSSR, Moskva (Institute of Crystallography of the AS USSR, Moscow)

SUBMITTED: May 15, 1959

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84081

S/181/60/002/009/022/036
B004/B056

6,4780

AUTHORS: Fridkin, V. M., Bogatyrev, A. N., Brakhman, E. V.

TITLE: A Parallel Investigation of the Depolarization and Electroluminescence of ZnS Photoelectrets

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 9, pp. 2185 - 2190

TEXT: The authors give a brief report on the results obtained by earlier papers (Refs. 1,2) on the dark polarization and depolarization of ZnS, and mention an experimental arrangement according to H. Kalman and B. Rosenberg (Ref. 3); in which two ZnS samples are fitted between three semitransparent electrodes; the photoelectret state was brought about in the first sample, and an alternating field (f = 2 kc/sec) was applied to the second sample. These experiments were carried out in the authors' laboratory by S. K. Balabanov, collaborator of the Chair of Experimental Physics of Sofia University. The following parallel tests are dealt with in detail: 1) Direct-current voltage of 300 v was applied to a ZnS-Cu electro-luminophore. Exposure to ultraviolet rays lasting 10 sec followed, and after 30 sec the voltage was switched off, the ZnS sample remained

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in the dark for 5 min with short-circuited electrodes; this was followed by depolarization with ultraviolet, and the initial value $i_{ph.d}$ of the depolarization current was measured. The same experiment was carried out using alternating current, and $i'_{ph.d}$ was measured. The value $\Delta i_{ph.d} = i_{ph.d} - i'_{ph.d}$ was determined for various voltages and frequencies. 2) Experiments without preceding exposure gave the values i_d for dark polarization in the case of direct current, i'_i for alternating current, and $\Delta i_d = i_d - i'_d$. A ЗГ-10 (ZG-10) generator was used as current source. The luminous power I was measured by means of a two-stage photomultiplier. The following relations are given: $i_{ph} = i_{ph.d} - i_d$ (1); $\Delta i_{ph}/i_{ph} = (i'_{ph.d} - i'_d)/(i_{ph.d} - i_d)$ (2); $\Delta i_{ph.d}/i_{ph.d} = (i_{ph.d} - i'_{ph.d})/i_{ph.d}$ (3); $\Delta i_d/i_d = (i_d - i'_d)/i_d$ (4). Fig. 1 shows $\Delta i_i/i_i$; $\Delta i_{ph.d}/i_{ph.d}$, $\Delta i_{ph}/i_{ph}$ and I as a function of the alternating voltage at 2kc/sec, and Fig. 2 shows $\Delta i_d/i_d$, $\Delta i_{ph}/i_{ph}$ and I as a function of frequency. These results

led to the conclusion that the decrease of dark polarization in the alternating-current field is not caused by electroluminescence as it begins already at low values of I. $\Delta i_{ph}/i_{ph}$, on the other hand, as a function of frequency shows a marked maximum which is explained by an increase of I with increasing frequency. The results are interpreted in detail on the basis of the tunnel mechanism of electroluminescence suggested by F. F. Vol'kenshtevn (Ref. 4) (Fig. 3). It is shown that no photo-excitation, but an electroexcitation occurs. The deep levels of the activator are excited directly by the field, and luminescence occurs by the recombination of conduction electrons with holes on the activator level. A considerable part of the dark polarization is due to the localization of electrons on deep levels. The authors thank I. N. Orlov for the ZnS samples placed at their disposal, and they express their gratitude to Academician A. V. Shubnikov, Academician G. Nadzhakov, and I. S. Zheludev for their interest. There are 3 figures and 5 references: 4 Soviet and 1 US.

84081

A Parallel Investigation of the Depolarization and Electroluminescence of ZnS Photoelectrets

S/181/60/002/009/022/036
B004/B056

ASSOCIATION: Institut kristallografii AN SSSR, Moskva (Institute of Crystallography of the AS USSR, Moscow)

SUBMITTED: October 26, 1959

Card 4/4

S/077/60/005/003/003/009
E032/E414

AUTHORS: Golovin, B.M., Zheludev, I.S., Kashukeyev, N.T. Fridkin, V.M. and Antonov, A.

TITLE: Electrophotography of Proton Beams 19

PERIODICAL: Zhurnal nauchnoy i prikladnoy fotografii i kinematografii, 1960, Vol.5, No.3, pp.207-208 + 1 plate

TEXT: A study is reported of the sensitivity of various electrophotographic layers to fast protons. The experiments were carried out on the synchrocyclotron of the Joint Institute for Nuclear Studies. The maximum intensity of the proton beam was about 10^8 protons/cm^2/sec and the energy of the protons was 680 Mev. Various electrophotographic layers were investigated, including ZnO, ZnS, CdS and polycrystalline sulphur, all deposited on paper. The electrophotographic layers were prepared by the method described in a previous paper (Ref.1). The layers were negatively charged by a corona discharge in air. The charged layers were then placed in a special holder which was fixed to the collimator with its plane perpendicular to the beam. After the exposure had been carried out the image was developed using a liquid electrophotographic developer described by two of the present authors in Ref.2. Dry

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E032/E414

Electrophotography of Proton Beams

developers (Ref.1) were used in the case of the sulphur layers. Fig.1 shows four electrophotographic images of the proton beam obtained in the ZnO layer with the beam in various angular positions relative to the axis of the collimator. As can be seen, these photographs can be used in the adjustment of the position of the proton beam. The electrophotographs shown in Fig.1 have a non-uniform background which is due to an edge effect associated with the electrostatic nature of the latent electrophotographic image. These edge effects can be reduced with the aid of a suitable screen. Fig.2 shows the photographs obtained with and without the screen (a and b respectively). It was found that electrophotographic layers of ZnO and polycrystalline sulphur are the most sensitive to protons. With maximum intensity of the proton beam, the minimum exposure time at 680 Mev was found to be 5 to 10 sec. It was found that the ZnO film has a similar characteristic curve to an X-ray film. The electrophotographic layer has a higher contrast but the latitude is smaller than in the case of the X-ray film. It follows that small irregularities in the beam are better defined in the electrophotographic method. Acknowledgments are expressed

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E032/E414

Electrophotography of Proton Beams

to V.P.Dzhelepov, Academician G.S.Nadzhakov and Academician A.V.Shubnikov for their interest. There are 4 figures and 2 Soviet references.

ASSOCIATIONS: Institut kristallografii AN SSSR (Institute of Crystallography AS USSR)
Institut fiziki Bolgarskoy AN (Institute of Physics of the Bulgarian AS)
Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute for Nuclear Studies)

SUBMITTED: July 11, 1959

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ANFILOV, I.V.; FRIDKIN, V.M.

Kinetics of the development of the electro-photographic latent image. Zhur.nauch. i prikl.fot i kin. 5 no.5:367-368 S-O '60. (MIRA 13:12)

1. Nauchno-issledovatel'skiy institut Poligrafmash.
(Photography--Developing and developers)

24.7700

68982
S/020/60/131/02/020/071
B013/B011

AUTHOR: Fridkin, V. M.

TITLE: Some Effects Observed in the Investigation of the Luminescence of ZnS Electrets

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 131, Nr 2, pp 290-292 (USSR)

ABSTRACT: In his investigation of electroluminescent ZnS electrets the author observed certain effects which are qualitatively described in the present paper. Experiments were made on ZnS which was activated with copper. The electroluminophore was dispersed in an alcoholic solution of polyvinyl butyral in the weight ratio 10:1. The polycrystalline layers were prepared by applying an emulsion to semiconducting glass or paper. The aim of the investigation under review was not the separation of the effects depending on the internal polarization of the electroluminophore layer (heterocharge) and on the adsorption of ions from the discharge interval on the electret surface. Only the fact that the effects observed are basically dependent on the large homocharge of the ZnS electrets was of interest. The author observed intense luminescence of the ZnS electrets under the action of a constant electric field. This luminescence was considerably stronger than that of uncharged ZnS

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layers under the action of an equally strong constant electric field. Intensity and duration of luminescence were the greatest when the direction of the field applied to the electret was opposed to the direction of the field during the ZnS polarization. A repeated application of the field to the layer allowed its charged regions to light up strongly, and the latent electrophotographic image thus became visible. The effect described here is clearly connected directly with a phenomenon which had been already observed by I. N. Orlov and I. Ya. Lyamichev. On the strength of the author's observation, the electret state in the samples of electroluminescent zinc sulfide under investigation intensifies the fluorescence of these samples. The effect described here is similar to that observed by G. Destriau (Ref 7). The author further observed another peculiar effect, which is similar to thermoluminescence. Heating of the electret allows it to become intensely luminescent (green luminescence), in which case luminescence weakens with increasing depolarization of the electret. All effects observed and enumerated by the author are brought about by a sufficiently strong internal field in the ZnS thermoelectret. In the author's opinion these effects can be explained by the scheme suggested by F. F. Vol'kenshteyn

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Some Effects Observed in the Investigation of the Luminescence of ZnS Electrets

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(Ref 3). Intensification of luminescence when heating the electret - a phenomenon analogous to thermoluminescence - permits the simultaneous investigation of the curves of thermoluminescence and depolarization for the corresponding crystal. The effects observed allow a visualization of the latent electrophotographic image without using the usual electrophotographic developers. The effects described here are now being investigated quantitatively in greater detail. The author thanks Academician A. V. Shubnikov and I. S. Zheludev for their interest, and I. N. Orlov for having supplied the samples of the electroluminophore used for the investigation. There are 1 figure and 7 references, 6 of which are Soviet.

ASSOCIATION: Institut kristallografii Akademii nauk SSSR (Institute of Crystallography of the Academy of Sciences of the USSR)

PRESENTED: November 20, 1959, by A. V. Shubnikov, Academician

SUBMITTED: November 18, 1959

Card 3/3

ADIROVICH, E.I.; FRIDKIN, V.M.

Reciprocity law and the quasi-stationary state. Zhur. nauch. i prikl. fot. i kin. 6 no. 3:233-234 My '61. (MIRA 14:5)

1. Fizicheskiy institut im. P.N. Lebedeva AN SSSR i Institut kristallografii AN SSSR.
(Xerography)

24.3500 1035, 1138, 1155
3.1205 (1395)

22872
S/077/61/006/004/004/004
D051/D113

AUTHORS: Zheludev, I.S.; Barulin, Yu.N.; and Fridkin, V.M.

TITLE: On a new version of the process of electronic photography

PERIODICAL: Zhurnal nauchnoy i prikladnoy fotografii i kinematografii, v. 6, no. 4, 1961, 300-301

TEXT: The authors propose a new method of electronic photography which is essentially different from the usual versions where the latent image is dependent upon the distribution of charges on the layer surface. The method excludes the use of any developers known in electronic photography. It is based on the application of a reverse electrical field and the photographic process is negative. Previous investigations (Ref. 1) revealed electroluminescence of permanently polarized ZnS layers under the action of a constant electric field. The duration and intensity of this phenomenon, which is particularly pronounced in ZnS-Cu polycrystalline layers when a constant electric field opposite in direction to that of the initial field is applied, depend on the charge density of the layer surface and on the layer properties. It was established (Ref.1) that when such a polarized layer is irradiated in the near infrared region, an uncommon extinguishing effect is

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On a new version of the process ....

observed, consisting in a diminution of luminescence on the application of the reverse electric field to the layer. On radiation the density of the surface charge remained practically unchanged, i.e. the indicated effect is not due to depolarization. Experiments were conducted in order to obtain and visualize the latent image on ZnS-Cu layers according to the above-mentioned method. Activated ZnS powder was dispersed in an alcohol solution of polyvinylbutyral. The layers, which were approximately 100μ thick and coated on paper, were subjected to a corona discharge and exposed through a negative film. A standard incandescent bulb, where T_{lum} =2850°K, served as the light source. The use of light filters permitted the layer to be exposed in different spectral regions. The latent image was visualized by applying a reverse electric field to the exposed layer. In this way images could be obtained in the near infrared region for $\lambda < 1.1\mu$. At present, the sensitometric aspects of this process, the resolving power of the layer, and other characteristics are being investigated. The authors also emphasize that the process studied by them is basically different from the photographic process described by H.Kallmann and J. Rennert (Ref. 2: J.Opt.Soc.America, 1958, 48, 812). I.N. Orlov and A.M.Bonch-Bruyevich are thanked for their help.

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On a new version of the process B051/B113

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[Abstracter's note: essentially full translation] . There are 2 references: 1 Soviet and 1 non-Soviet-bloc reference.

ASSOCIATION. Institut kristallografii AN SSSR (Institute of Crystallography AS USSR)

SUBMITTED: January 4, 1961

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24417
S/051/61/011/001/004/006
E036/E435

24,3500

AUTHOR: Fridkin, V.M.

TITLE: On the light emission of charged polycrystalline ZnS layers under the action of d.c. electric fields

PERIODICAL: Optika i spektroskopiya, 1961, Vol.11, No.1, pp.105-111

TEXT: Luminescent effects are observed if a d.c. electric field is applied to a zinc sulphide layer in a direction opposed to a polarizing field. The intensity of the radiation can be reduced by irradiation with ultraviolet light, an effect which can be used for a photographic process. The major effect has been described previously by the author. In the experiments, ZnS activated with copper and chlorine were used, prepared by a method described in earlier work (Ref.2: I.N.Orlov. Izv.AN SSSR, ser.fiz., 21,731,1957). In the earlier experiments (Ref.1: V.M.Fridkin. DAN SSSR, 131, 2, 1960) the strong polarizing field uniformly charged the ZnS layer and application of a field in the opposite direction produced strong luminescence which was not observed if the field was in the same direction as the polarizing field. If the field is less than the polarizing field then the luminescence can be observed repeatedly. In these experiments the ZnS layer was 3 mm and the polarizing

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voltage 6 kV whilst the subsequently applied voltage was 300 V in the opposite direction. The luminescence could be observed again if a voltage of 1 kV was used, and so on, until application of a further polarizing field became necessary. This work was extended in the present article to clarify the mechanism and its relation to electroluminescence. It had been noted that the observed radiation was in the green whereas electroluminescence of the ZnS-Cu,Cl is in the blue. The construction of the condenser used is outlined briefly. The luminescent signal was detected by a photo-multiplier and the decay of the radiation displayed on an oscilloscope and photographed so that the integrated radiation could be determined. The charge on the surface of the ZnS layer was determined with an electrostatic voltmeter as described in "Photoelectrets and Electrophotographic Processes" (by the author and I.S.Zhelyadev, Ref.3: Fotoelektrety i elektrofotograficheskiy protsess. Izd. AN SSSR, M., 1960). Thus, plots of integrated light S against charge density on the layer $\sigma \cdot 10^9$,Coul/cm^2 for various values of the reverse field E, kV/cm were obtained, Fig.2 (curve 1 - E = 25 kV/cm; curves 2 to 5 - E = 21, 17, 14 and 7 kV/cm respectively). The decrease in the charge as a function of

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the applied field and the duration of application was also investigated. It was found that the change of charge was almost independent of duration of voltage application in the range from 4msec to several seconds. The decay of charge does not therefore exceed 4 m sec. Since the light pulse lasts for tenths of seconds, it is suggested that the role of the field is to excite the corresponding electron or hole levels and the emission can occur without a field being present by a recombination process. Some results for other ZnS crystals are given. In particular, in all cases, the luminescence discussed is in a different band from that obtained in electroluminescence. Thus for ZnS-Cu,Pb,Cl charged layer luminescence, fluorescence and phosphorescence occurs in the green whereas electroluminescence is in the blue. For ZnS-Cu,Mn,Cl, electroluminescence, phosphorescence and fluorescence are in the yellow but charged layer luminescence is in the red-orange band. ZnS, ZnSe-Cu,Cl do not exhibit the effect of phosphorescence whilst the other effects are in the orange. This is also true of ZnS, CdS, ZnSe-Cu,Cl but the electro-luminescence and fluorescence are in the red. It is also noted