Tolstoy, N.A.

USSR/Optics - Physical Optics K-5

Abs Jour : Referat Zhur - Fizika, No 5, 1957, 12935

Author : Tolstoy, N.A., Tkachuk, N.N., Tsenter, M.Ya., Mansurova, Z.S.

Inst : Leningrad Technological Institute, State Optical Institute USSR

Title : Investigation of the Scintillation of the Flash Flareup Curve for the Glow of the ZnS-Mn Phosphors.

Orig Pub : Optika i spektroskopiya, 1956, 1, No 5, 719-728

Abstract : A new procedure is proposed for the investigation of the flash flareup and attenuation of luminescence, based on the application of a one-shot light modulator (magnetoelectric gate, controlled by an electronic circuit). With the aid of this modulator, an investigation was made of the flash flareup of a series of ZnS-Mn phosphors.

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TOLSTOY, N.A.

ARKHANGEL'SKAYA, V.; TOLSTOY, N.; FEOFILOV, P.

Fifth Conference on Luminescence (crystal phosphors). Opt. i spektr. 1 no.6:813-820 O '56. (MLRA 9:12)

(Tartu--Luminescence--Congresses)

TOLSTOY, N.A.

Permanent dipole moment of aerosol particles. A. A. Spartakov and N. A. Tolstoi. *Soviet Phys., JETP* 2, 328(1956)(Engl. translation).—See C.A. 50, 3034g.

B. M. R.

B-5

TOLSTOY, N.A.

USSR/Crystals.

Abs Jour : Referat Zhur - Khimiya, No 6, 1957, 18329

Author : N.A. Tolstoy, A.K. Trofimov, A.M. Tkachuk, N.N. Tkachuk.

Title : Luminescence Kinetics of Platinum Cyanide Compounds.

Orig Pub : Izv. AN SSSR, ser. fiz., 1956, 20, No 5, 583-590

Abstract : The kinetics of the luminescence of anhydrous and hydrous salts of M/ $Pt(CN)_4$ /, where M may be Li, Na, K, Po, Cs, Mg, Ca, Sr, Ba, Y, La, Pr, Nd, Sm, Gd, Dy, Er, Tu, Yb, was studied with an ultrataumeter. In case of all these salts, the brightness of the stationary luminescence is in proportion to the excitation intensity, the intensity rise and quenching curves are symmetrical and exponential. The relaxation time is 10^{-6} to 10^{-7} sec. The luminescence kinetics depends in a complicated manner on the cation nature, the amount of water of crystallization and the crystalline structure of polymorphous modifications. The luminescence kinetics and the luminescence spectrum

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TOLSTOY, N. A.

2000

535.371

5015. ON THE POSSIBILITY OF A TWO-STEP MECHANISM OF EXITATION IN SULPHIDE PHOSPHORS. N.A.Tolstoi. Zh. éksper. teor. Fiz., Vol. 30, No. 1, 171-9 (1956). In Russian.

1

The experimental data on kinetics of luminescence of strongly-quenched phosphors show that, opposite to the widely spread opinion, the bimolecular theory does not give a correct explanation. An interpretation of experiments is given, based on the mechanism of a two-step excitation of luminescence. It is shown that the photo-conductivity of CdS highly activated with copper is excited by a "two step" process. At the same time the luminescence of this substance shows regularities typical of the case of strong quenching. A.

TOLSTOY, N.A.

USSR/ Physical Chemistry - Crystals B-5

Abs Jour : Referat Zhur - Khimiya, No 4, 1957, 11000

Author : Tolstoy N.A., Kolomiyets B.T., Golikova O.I., Tsentner M.Ya.
Title : Photoconductivity and Luminescence of Polycrystalline CdS(Cu)

Orig Pub : Zh. eksperim. i teor. fiziki, 1956, 30, No 3, 575-576

Abstract : In the case of polycrystalline samples of CdS-Cu (10^{-6} - 5.10^{-4} g/g)were investigated: dependence of stationary photoconductivities and luminosity of glow on intensity of exciting light E (Hg-lines 365, 546 and 578 mμ), and also the ratios of surface areas below the curves of photoconductivity rise and drop, and below the curves of increase and attenuation of the glow. The conclusion is reached that results are conflicting with any recombination scheme of the glow and are in accord with the theory of a 2-step mechanism of excitation (Loshkarev V.Ye., Fedorus G.A., Izv. AN SSSR, Ser. fiz., 1952, 16 81; RZhKhim, 1956, 64335).

Card 1/1

Tolstoy, N. A.

US[illegible]R/Physical Chemistry - Crystals. B-5

Abs Jour: Referat. Zhurnal Khimiya, No 2, 1958, 3673.

Author : N. A. Tolstoy.
Inst : Academy of Sciences of USSR.
Title : Scintillating Luminescence Rise in Zinc-Sulfide Phosphors and Two-Step Excitation Mechanism.

Orig Pub: Dokl. AN SSSR, 1956, 111, No 3, 582-584

Abstract: It was revealed by new methods (RZhKhim, 1957, 18331) that the scintillating rise (SC) of the long wave luminescence band (Tolstoy N.A., Feofilov P.P., Dokl. AN SSSR, 1949, 68, 285) was observed to take place in a great many phosphors with ZnS base (excitation of $\lambda = 365$ mμ), for example in ZnS-Ni; ZnS-Ni, Ag; ZnS-Co; ZnS-Fe; ZnS-Eu; ZnS-P; ZnS-Cu and in activatorless ZnS. The characteristics of SC are discussed and a luminescence mechanism of phosphors possessing SC is proposed. The initial

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USSR/Physical Chemistry - Crystals.

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Abs Jour: Referat. Zhurnal Khimiya, No 2, 1958, 3673.

action of the exciting light transfers electrons from the conductivity zone (or from the non-excited activator levels) to local levels (LL). The electron number on a LL is limited by the fact that they are rejected from the LL to the conductivity zone by the secondary action of the exciting light and leave spontaneously to the scintillation levels. Radiationless transitions from LL and scintillation levels into the valence zone are also possible. The SC phenomenon and the phosphor characteristics are explained using this model. It is shown that SC is an autostimulation with exciting light.

Card : 2/2

[illegible] electroconductive, the r began [illegible] the ratio of

TOLSTOY, N.A.; SPARTAKOV, A.A.; KHIL'KO, G.I.

Electrooptical properties of lyophobic colloids. Part 1:
Statement of the problem, principal methods and results.
Koll. zhur. 22 no. 6:705-716 N-D '60. (MIRA 13:12)

1. Leningradskiy tekhnologicheskiy institut imeni Lensoveta,
Kafedra fiziki.
(Colloids--Optical properties)

FABRIKANT, Valentin Aleksandrovich, prof., doktor fiziko-matem. nauk; CHERENKOV,
Pavel Alekseyevich, prof., doktor fiziko-matem. nauk, laureat Nobelevskoy
premii; GALANIN, Mikhail Dmitriyevich, prof., doktor fiziko-matem. nauk;
KUZNETSOV, Ivan Vasil'yevich; TOLSTOY, Nikitia Alekseyevich, prof.,
doktor fiziko-matem. nauk; VINTER, Aleksandr Vasil'yevich, akademik
[deceased]; BARDIN, Ivan Pavlovich, akademik [deceased]; BAZHENOV, A.I.,
FAYNBOYM, I.B., red.; RAKITIN, I.T., tekhn. red.

Sergei Ivanovich Vavilov; sbornik. Moskva, Izd-vo "Znanie,"
1961. 43 p. (Vsesoiuznoe obshchestvo po rasprostraneniiu po-
liticheskikh i nauchnykh znanii. Ser.9, Fizika i khimiia,
no.10) (MIRA 14:7)
(Vavilov, Sergei Ivanovich, 1891-1951)

TOLSTOY, N.A

51-6-11/26

AUTHORS: Tolstoy, N. A., Tkachuk, A. M. and Tkachuk, N. N.

TITLE: Flash Emission of Luminescence. (Vspyshechnoye razgoraniye lyuminestsentsii.) 1. ZnS-Ni Bhosphors. Part I. (1. Fosfory ZnS-Ni. Chast' I.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.II, Nr.6, pp. 759-769. (USSR)

ABSTRACT: The red band of the ZnS-Ni phosphor exhibits flash emission. The phosphor was excited with 365 $m\mu$ line of mercury. The flash was observed using a light filter. The intensity of the flash increased with the duration of the dark interval between two consecutive excitations, t_0. The maximum intensity was reached at a value of t_0 which increases with decrease of temperature (see Fig.1). Preliminary illumination of the excited phosphor with infrared and green-orange light affected the flash emission. The infrared illumination shortened the dark interval before the flash but did not affect the maximum flash

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51-6-11/26

Flash Emission of Luminescence. 1. ZnS-Ni Phosphors. Part I.

intensity. Illumination with 578 or 546 mμ lines of mercury decreased the ability of the phosphor to emit in a flash. If this green-orange illumination was of sufficient power and duration the flash emission disappeared altogether. The ZnS-Ni phosphor which can emit in a flash was found to possess a wide band of complementary absorption (Fig.5). It was also found that kinetics of the blue-band emission (Zn) is closely related to kinetics of the red band (Ni). The authors suggest that flash emission is due to transitions of electrons or holes from one localised - state ("first localisation") to another such state ("second localisation"). Students of the Leningrad University A. Yeremeyeva and O. Popova, took part in this work. There are 6 figures and 10 references, 9 of which are Slavic.

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51-6-11/26

Flash Emission of Luminescence. 1. ZnS-Ni Phosphors. Part I.

ASSOCIATION: State Optical Institute imeni S.I. Vavilov; Leningrad Technological Institute imeni Lensovet, Chair of Physics. (Gosudarstvennyy opticheskiy institut im. S.I. Vavilova; Leningradskiy tekhnologicheskiy institut im. Lensoveta, Kafedra fiziki).

SUBMITTED: November 28, 1956.

AVAILABLE: Library of Congress.

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Tolstoy, N. A.

51-1-10/18

AUTHOR: Tolstoy, N. A.

TITLE: On Relationship of the Blue and Red Emission Bands in the ZnS-Co Phosphor. (O vzaimnoy svyazi goluboy i krasnoy polos svecheniya v fosfore ZnS-Co.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.III, Nr.1, pp.73-75. (USSR)

ABSTRACT: This paper reports preliminary results of investigation of the relation of the steady-state emissions of the blue (Zn) and red (Co) bands of the ZnS-Co phosphor containing five parts per million by weight of Co. The author suggests that the transfer of electrons and holes responsible for the flash emission in the red band of this phosphor also occurs during steady-state excitation. This transfer of electrons or holes consists in transitio from short-wavelength centres (the so-called first localization levels) to other, energetically lower, localized states (second localization) which are located at the long-wavelength centres of emission. The speed of this

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51-1-10/18

On Relationship of the Blue and Red Emission Bands in the ZnS-Co Phosphor.

transfer increases with temperature. Such transfer would increase the steady-state brightness of the long-wavelength emission. This increase should be simply related to the number of electrons or holes transferred from the levels of first localization to the second set of levels in unit time. In its turn the number of such electrons or holes would be proportional to:
(a) the steady-state number of electrons or holes at the levels of first localization at a given exciting light intensity and a given temperature, and (b) the increasing with temperature probability of transition from the first localization to the second. Fig.1 shows dependence of the brightness of the red emission on E (exciting light intensity) at various temperatures t. The author interprets the observed dependence I(E) as follows. Below 0°C the function I(E) is linear because the red centres are excited directly by the incident light. At room temperature, and above, the I(E) curves consist of two components superimposed on each other. One is due to direct excitation of the red centres and has linear

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On Relationship of the Blue and Red Emission Bands in the ZnS-Co Phosphor.

dependence of I(E). The other is due to transitions from the first to the second localization levels. These first localization levels are "saturated" at all but the lowest values of E and therefore this component exhibits "saturation". At higher temperatures the transfer from the first to the second localization levels becomes more intense, the number of electrons or holes at the first localization decreases and eventually this number becomes proportional to E. Then the I(E) curves become linear again. The first localizational levels are attributed to the blue emission band of ZnS-Co and the second ones to the red emission band. The temperature dependences of emission for these two bands are shown in Fig.2. There are 2 figures and 5 references, all of which are Slavic.

SUBMITTED: February 26, 1957.

AVAILABLE:

TOLSTOY, N.A.

51-5-7/11

AUTHORS: Tolstoy, N.A. and Sokolov, V.A.

TITLE: Some Luminescence and Photoelectric Properties of Polycrystalline Cadmium Selenide (Nekotorye lyuminestsentnye i fotoelektricheskiye svoystva polikristallicheskogo selenida kadmiya)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.III, Nr 5, pp.495-503 (USSR)

ABSTRACT: Luminescence spectra of cadmium selenide have been photographed, using the apparatus of Galkin (Ref.14) including the infra-red region. Fig.1a shows the luminescence spectra of cadmium selenide at 20°C and -183°C. As can be seen, the luminescence band at room temperature (Curve 1) has a simple bell-shaped form with a half-width of 290 mμ and a maximum at 1.14μ. At liquid oxygen temperatures a more intense "cold" maximum appears at 0.9μ while the position of the "hot" maximum remains the same. The phenomenon is characteristic of the majority of phosphors of the sulphide type with two luminescence bands. Fig.1b shows luminescence spectra of CdSe-Cu at -183°C. As can be seen, the introduction of copper (CdSe-Cu I), leads to the appearance of a bright band with a maximum at 0.91μ, accompanied

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51-5-7/11

Some Luminescence and Photoelectric Properties of Polycrystalline Cadmium Selenide.

by a very small maximum at 1.15 μ which obviously coincides with the "hot" maximum in a pure CdSe. In the spectrum of CdSe-Cu II (the continuous line Fig.1b) there is only one short wave maximum at 0.92 μ. The time of relaxation of the luminescence of pure CdSe is estimated to be of the order of 10^{-4} sec at room temperature. The relaxation is not exponential and the form of the curve is a function of intensity of the excited radiation and the temperature. Fig.2 shows the dependence of the stationary photoconductivity on the wavelength at room temperature. The photoconductivity of CdSe has a selective maximum at $\lambda = 0.71$ to 0.72 μ (Fig.2, 1). For wavelengths less than 0.5 μ the photoconductivity is practically zero. The long wavelength limit is at 1.2 μ. This is in agreement with the work of Eckart and Schmidt (Ref.15). The spectra of CdSe-Cu are different from the spectra of the pure CdSe. The maximum of the curve has shifted towards the long wavelengths and does not fall off so rapidly on the long wavelength side. Pure CdSe has a conductivity proportional to E^q where E is the intensity of the exciting radiation. Fig.3 shows the dependence of q on temperature. The curve has a maxi-

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Some Luminescence and Photoelectric Properties of Polycrystalline Cadmium Selenide.

mum at about -15°C where $q = 2$. Experiments on CdSe at $t = -15$°C and $q = 2$ have shown that :

$$\Delta\sigma_{\infty} \sim E^2 ,$$

$$L_n / L_s \gg 1 \qquad \text{and}$$

$$\Delta\sigma_n \sim t^2 \text{ at } t \to 0$$

where L_n is the area under the curve of rising conductivity and L_s is the area under the curve of falling conductivity. Experiments on relaxation curves at room and higher temperatures have established the presence of "flares" in the photoconductivity. This means that the value of photoconductivity during the first few moments after the exclusion of the exciting radiation is higher than the stationary value (cf Fig.5). The ratio of the maximum value of photoconductivity to the stationary value is a function of the

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51-5-7/11

Some Luminescence and Photoelectric Properties of Polycrystalline Cadmium Selenide.

"dark" period between successive excitations. The ratio increases with the duration of this "dark" period until it reaches a certain value and then remains constant. This constant value of the ratio increases with temperature and reaches a maximum at 120°C, after which it decreases again. The value of the above ratio also depends on the intensity of the exciting radiation. A negative "flare" has also been observed. This means that the photoconductivity has a lower value during an interval of time immediately after irradiation than during the "dark" period. This negative "flare" is only observed at sufficiently high temperatures. During experiments on the photoconductivity of CdSe it was found that the addition of a UV excitation to a constant long wavelength excitation leads to a rapid decrease in the photoconductivity. The majority of the above phenomena occur also in cadmium sulphide.

There are 8 figures and 18 references, 12 of which are Slavic.

ASSOCIATION: State Optical Institute, Leningrad Technological Institute, Chair of Physics (Gosudarstvennyy opticheskiy institut Leningradskiy tekhnologicheskiy institut Kafedra fiziki)

Card 4/5

TOLSTOY N.A.

LANDSBERG, G.S., [deceased], akademik; LEBEDEV, A.A., akademik; RONKI, VASKO [Ronchi, Vasco]; ARBUZOV, A.Ye.; TOLSTOY, N.A.; VINTER, A.V., akademik; BARDIN , I.P., akademik.

Recollections about Sergei Ivanovich Vavilov. Trudy Inst.ist. est.i tekh. 17:137-153 '57. (MLRA 10:7)

1. Direktor Natsional'nogo opticheskogo instituta, Archetri (Florentsiya) (for Ronki).
(Vavilov, Sergei Ivanovich, 1891-1951)

Tolstoy, N.A.

48-4-4/48

SUBJECT: USSR/Luminescence

AUTHORS: Tolstoy N.A. and Shatilov A.V.

TITLE: On the Possibility of Two-Step Excitation of Photosemiconductor Phenomena (O vozmozhnosti dvukhstupenchatogo vozbuzhdeniya fotopoluprovodnikovykh yavleniy)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1957, Vol 21 #4, p 494 (USSR)

ABSTRACT: A number of stationary and relaxation regularities in luminescence and photoconductivity cannot be accounted for by existing theories. These regularities are characteristical for phosphors and photoresistances which are quenched by temperature.

For explanation of these regularities a two-step mechanism of electron excitation in the pseudomolecular character of recombination can be proposed. Equations of the two-step theory qualitatively agree with experience when quenching is absent or insignificant.

In particular, photoconductivity is found to be proportional to the square root of excitation intensity within a wide range

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48-4-4/48

TITLE: On the Possibility of Two-Step Excitation of Photosemiconductor Phenomena (O vozmozhnosti dvukhstupenchatogo vozbuzhdeniya fotopoluprovodnikovykh yavleniy)

of variations of the latter. This conclusion agrees with the well-known law for the conventional photoconductivity.

Three Russian references are cited.

INSTITUTION: Not indicated.

PRESENTED BY:

SUBMITTED: No date indicated

AVAILABLE: At the Library of Congress.

Card 2/2

Tolstoy, N.A.

48-4-5/48

SUBJECT: USSR/Luminescence

AUTHORS: Tolstoy N.A., Tkachuk A.M., Tkachuk N.N. and Mansurova Z.S.

TITLE: Flash Brightness Rise of Zinc-Sulfide Phosphors (Vspyshechnoye razgoraniye tzink-sul'fidnykh fosforov)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1957, Vol 21, #4, pp 495-498 (USSR)

ABSTRACT: A rise in the flash brightness of the luminescence long-wave band is observed in ZnS-Mn; ZnS-Ni; ZnS-Co and also in the "pure" ZnS (apparently due to iron admixtures). The flash may be 6.5 times as bright as stationary phosphorescence of ZnS-Ni.

The intensity of flash depends on the duration of interruption of t_o in excitation illumination. There is an optimum time of $t_{o\ max}$ ("ripening time") which corresponds to maximum flash. The value of $t_{o\ max}$ depends on the phosphor composition and temperature. Temperature-dependence of $t_{o\ max}$ is expressed by the following equation: $\frac{1}{t_{o\ max}} \approx e^{-u/kT}$

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48-4-5/48

TITLE: Flash Brightness Rise of Zinc-Sulfide Phosphors (Vspyshechnoye razgoraniye tzink-sul'fidnykh fosforov)

The process of flash "ripening" is interpreted as a thermal transfer process of electrons from the local "supply levels" to the local "flash levels". After a sufficient time, electrons leave thermally also flash levels. The law cited above can be derived on the basis of these conceptions.

The article is followed by a discussion of the topics touched in the report.
No references are given.

INSTITUTION: Not indicated

PRESENTED BY:

SUBMITTED: No date indicated

AVAILABLE: At the Library of Congress.

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Tolstoy, N.A.

48-4-14/48

SUBJECT: USSR/Luminescence

AUTHORS: Tolstoy N.A., Tkachuk N.N. and Preobrazhenskiy R.K.

TITLE: Kinetics of Infra-Red Luminescence of couprous Oxide (Kinetika infrakrasnogo svecheniya zakisi medi)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1957, Vol 21, #4, pp 521-522 (USSR)

ABSTRACT: Development of the ultrataumeter made it possible to investigate luminescence kinetics of couprous oxide.

The study of dependence of luminescence relaxation time τ on temperature and content of ultra-stoichiometric oxygen has shown the following: τ anomalously increases from 5×10^{-8} to 5×10^{-6} sec with the temperature rise from -183°C. At the room temperature the τ-value ceases to rise and falls at the further heating (temperature quenching).

The increase in oxygen content leads to τ-decrease at all temperatures except the lowest.

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48-4-14/48

TITLE: Kinetics of Infra-Red Luminescence of couprous Oxide (Kinetika infrakrasnogo svecheniya zakisi medi)

Citing the 3 possible ways of accounting for the τ-rise with temperature, the author favors the third one according to which the absorption mechanism bears an excition character. Exciton decay on a charged acceptor leads to photoconductivity, and on an uncharged acceptor leads to luminescence. Assuming that the cross section of exciton capture is larger for the uncharged acceptor, the total cross section of all exciton capture centers decreases with temperature rise and the τ-value of luminescence increases.
The report is followed by a discussion.
No references are cited.

INSTITUTION: Not indicated

PRESENTED BY:

SUBMITTED: No date indicated

AVAILABLE: At the Library of Congress.

Card 2/2

Tolstoy, N. A.

48-4-43/48

SUBJECT: USSR /Luminescence

AUTHORS: Tolstoy N.A., Tkachuk A.M. and Tkachuk N.N.

TITLE: Ultrataumeter (Ul'trataumetr)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1957, Vol 21, #4, pp 595-611 (USSR)

ABSTRACT: In order to measure relaxation processes whose duration is within the limits from 10^{-5} to 10^{-7} sec, a special apparatus, "ultrataumeter", was designed and constructed. Investigations of the kinetics of some luminophores were carried out with the aid of this apparatus.

The ultrataumeter uses photoelectronic multipliers. One of them is of the FEU-19 type (antimony-cesium pnotocathode), and the other one of the "AEG" firm (cesium oxide photocathode). The multipliers are supplied from a rectifier with electronic stabilization.

As the Soviet industry does not manufacture oscillographs suitable for application in an ultrataumeter, a special oscillograph was designed and constructed by the authors. This

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TITLE: Ultrataumeter (Ul'trataumetr) 48-4-43/48

oscillograph is valuable also for the application of the method of electric differentiation. Its sensitivity to inertia is (1 to 2)$\times10^{-8}$sec. Its horizontal frequency characteristic ranges from 5 c/sec to 10 megac/sec at the value of gain factor k = 500 and to 3 megac/sec at k = 1,000.

A mechanical modulator of light can modulate the light of any spectral composition, within the limits of quartz lenses.

The practical resolution ability of the ultrataumeter with the mechanical light modulator amounts to 10^{-8}sec.

Two more ultrataumeters were constructed:

1. The ultrataumeter with an electro-optical modulator of light. It was designed for modulation of light within the visual portion of the spectrum. It was applied for studying kinetics of the infra-red luminescence of cuprous oxide.
2. The ultrataumeter for studying kinetics of cathodoluminescence. Relaxation times of cathodoluminescence up to 10^{-7} sec can be measured with the aid of this device.

The article contains 13 circuits and 4 figures.

The bibliography lists 25 references, all of which are Slavic (Russian).

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SOV/51-5-4-9/21

AUTHORS: Arkhangel'skaya, V.A. and Tolstoy, N.A.

TITLE: Kinetics of Luminescence of Certain Tungstates and of Zinc Oxide (Kinetika svecheniya vol'framatov i okisi tsinka)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 4, pp 415-422 (USSR)

ABSTRACT: The authors studied kinetics of photoluminescence and cathodoluminescence of $CaWO_4$, $CdWO_4$, $MgWO_4$, $ZnWO_4$, $CaMoO_4$ and ZnO. To study relaxation of cathodoluminescence the authors used the "taumeter method" (Refs 8, 9) with the following modifications: (A) An electron gun produced 2-keV electrons which were used to bombard phosphor samples deposited on chromium plated copper. This copper plate was used to vary the sample temperature from 20°C to 300°C. (B) A special wide-band (2 to 10^7 c/s) cathode-ray oscillograph was used. (C) Photomultipliers used were of Soviet (FEU-19, Sb-Cs type) and German (A.E.G., Cs oxide type) origin. To measure photoluminescence relaxation the authors used a "taumeter" (Ref 8) and the wide-band cathode-ray oscillograph referred to above. The cathodoluminescence relaxation of $CaWO_4$, $CdWO_4$, $MgWO_4$, $ZnWO_4$ and $CaMoO_4$ phosphors had

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Kinetics of Luminescence of Certain Tungstates and of Zinc Oxide

the following common characteristics: (1) the rise and decay curves of luminescence were symmetrical; (2) the form of relaxation curves does not depend on the current density in the electron beam; (3) at room temperature the relaxation curves are not of purely exponential nature. Fig 1 shows the decay curves for $MgWO_4$ (Fig 1a) and $CaWO_4$ (Fig 1b). Each of these curves may be represented by two exponential curves whose time constants τ do not differ much from one another. The values of the relaxation time τ given in this paper are the averages of the two values of τ obtained by fitting two exponentials to each decay curve. Dependence of τ on temperature is given, for the five phosphors listed above, in Fig 2. Fig 3 gives the dependences of the relative brightness I/I_{20} and the relaxation time τ/τ_{20} on temperature t. I_{20} and τ_{20} denote the brightness and the relaxation time at 20°C, and Fig 3 deals with $CaWO_4$ and $MgWO_4$ only. Relaxation of photoluminescence was also studied. Photoluminescence was excited using a mercury lamp SVDSh-250 (365, 334 and 313 $m\mu$). For all the five phosphors listed above the following characteristics of photoluminescence relaxation were noted: (1) the rise and decay curves of luminescence are symmetrical and are of purely exponential nature in a temperature

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Kinetics of Luminescence of Certain Tungstates and of Zinc Oxide

range from -183°C to +100°C; (2) the form of the decay curves does not depend on the intensity of excitation. Fig 4 gives the $\tau(t)$ curves for photoluminescence of $MgWO_4$, $ZnWO_4$, $CdWO_4$ and $CaMoO_4$. In addition to the four tungstates and one molybdate listed above the author studied two types of ZnO, which differed in their methods of preparation and spectral and relaxation properties. ZnO of type I was prepared from ZnS by oxidation at 800°C. Its photoluminescence spectrum, excited by 365 mμ, is shown in Fig 5, curve 2. It was found that the value of τ in photoluminescence of ZnO I was constant within the range of temperatures from -183°C to +20°C and was equal to 1.25×10^{-6} sec. Curve 1 in Fig 5 represents electron-excited cathodoluminescence of ZnO I. The temperature dependence of τ/τ_{20} and I/I_{20} for electron-excited ZnO I is shown in Fig 6. The cathodoluminescence decay of ZnO I consists of two processes:

(1) a fast exponential decay with $\tau = 1.25 \times 10^{-6}$ sec., and

(2) a slow non-exponential "tail" with $\tau \approx 10^{-4}$ sec. The value of τ for the exponential part of the cathodoluminescence decay of ZnO I does not depend on the electron beam density or electron energy. The exponential τ remains constant on heating up to 60°C, and then it falls

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SOV/51-5-4-9/21

Kinetics of Luminescence of Certain Tungstates and of Zinc Oxide

reaching 4.5×10^{-7} sec at 220°C. Above 145°C the non-exponential "tail" disappears completely. The second type of zinc oxide (ZnO II) is obtained by reduction of ZnO with lampblack above 1000°C. The photoluminescence spectrum of ZnO II is displaced towards longer wavelengths compared with the corresponding spectrum of ZnO I. The cathodoluminescence spectrum of ZnO II possesses also an emission band in the near ultraviolet (Refs 7, 12). X-ray diffraction showed that the lattices of ZnO I and ZnO II are identical. The differences between ZnO I and ZnO II lie only in the chemistry or topography of micro-defects. There are 6 figures, 1 table and 15 references, 10 of which are Soviet, 2 English, 1 Dutch, 1 American and 1 translation.

ASSOCIATION: Gosudarstvennyy opticheskiy institut im. S.I. Vavilova (State Optical Institute imeni S.I. Vavilov).

SUBMITTED: January 6, 1957

Card 4/4
1. Tungsten compounds--Luminescence 2. Zinc oxide--Luminescence
3. Electron bombardment--Applications 4. Phosphors--Properties

AUTHORS: Tolstoy, N.A. and Shatilov, A.V. SOV/51-5-5-14/23

TITLE: Formal Analysis of the Theory of Two-Step Excitation of Phosphorescence and Photoconductivity. (Formal'nyy analiz teorii dvukhstupenchatogo vozbuzhdeniya fosforestsentsii i fotoprovodimosti). II. Relaxation Relations (II. Relaksatsionnyye zavisimosti)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 5, pp 590-600 (USSR)

ABSTRACT: In Part I (Ref 1) the authors considered steady-state relations which followed from the two step excitation theory. The present paper discusses relaxation relations which correspond to rise or decay of phosphorescence and photoconductivity under excitation by square pulses of light. It is assumed that decay processes begin after reaching a state of equilibrium under the pulse excitation, and the rise processes are taken to occur after complete relaxation of the excited states. Rise curves are considered first and the structure of one such curve is shown in Fig 1. Decay curves are shown in Fig 2 curve 3 (which is the sum of exponential curves 1 and 2) and Fig 4 which shows a non-monotonic decay of a light-sum. Fig 3 illustrates relaxation processes as functions of the excitation intensity. The paper is entirely theoretical. There are 4 figures and 8 references, 7 of which are Soviet and 1 Polish.

Card 1/1

1. Phosphorescence--Theory 2. Photoconductivity--Theory 3. Photoconductivity--Excitation 4. Phosphorescent materials--Excitation 5. Phosphorescent decay

AUTHOR: Tolstoy, N.A.

SOV/51-6-1-29/30

TITLE: Optics at the International Congress on Solid-State Physics (Brussels, 1958). (Optika na mezhdunarodnom kongrese po fizike tverdogo tela (Bryussel', 1958))

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 1, pp 124-126 (USSR)

ABSTRACT: The International Congress on Solid-State Physics and its applications to electronics and telecommunication was held in Brussels between 2nd and 7th June, 1958. About 1000 participants and guests were present, including the following Soviet scientists: V.V. Antonov-Romanovskiy, B.M. Vul, D.N. Nasledov, A.N. Terenin and N.A. Tolstoy. 265 papers were presented at the Congress and the present report deals only with some of the papers on optics. The latter included a paper by V.V. Antonov-Romanovskiy who reported experiments on electroluminescence of ZnS powders and single crystals.

Card 1/1

24(4), 24(6)

SOV/51-6-5-16/34

AUTHORS: Tolstoy, N.A. and Tkachuk, A.M.

TITLE: Studies of the Spectral Distribution of the Luminescence Decay Time of Ruby, by the Pulse Taumeter Method (Issledovaniye spektral'nogo raspredeleniya vremeni zatukhaniya svecheniya rubina metodom impul'snogo taumetra)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 5, pp 659-664 (USSR)

ABSTRACT: Luminescence of ruby (Al_2O_3-Cr), originally thought to be rather simple (Refs 1, 2), was recently shown to behave in a complex fashion (Refs 3-5). Further experimental work is noted on this substance. The present paper reports studies of the emission-wavelength dependence of the decay constant τ ("the relaxation spectrum") of ruby using the pulse taumeter method (Ref 6). Fig 1 shows a taumeter with a pulse lamp IS-50 (I in Fig 1). This instrument is capable of measuring decay constants between 10^{-2} and 2×10^{-5} sec with an error of ±5%. The exciting light (340-600 mμ) from the lamp I was focused by a quartz condenser K_1 on to a sample O. Some of this light was scattered by the condenser surfaces and reached a photomultiplier FEU-1 (F_1). The signal from this multiplier was passed through an R-C circuit (the taumeter proper), was amplified and applied to the X-plates of a c.r.o. EO-7

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V/51-6-5-16/34

Studies of the Spectral Distribution of the Luminescence Decay Time of Ruby, by the Pulse Taumeter Method

(K.O. in Fig 1). Luminescent light was focused by a second quartz condenser K_2 on to the entry slit of a monochromator fitted with a diffraction grating (600 lines/mm, linear dispersion 6.5 Å/mm). Luminescence which emerged through the exit slit of the monochromator was focused by a lens L_1 on to a second photomultiplier FEU-2 (F_2) whose signal was amplified and applied to the Y-plates of the c.r.o. Measurement of τ took less than 1 min (for details see Tolstoy, Ref 6). Six samples of ruby were studied in which the amount of chromium varied from 0.05 to 2.89%. Two series of measurements were made. In the first series the luminescence spectrum of ruby was recorded by means of a pulse lamp and an oscillograph and then the value of τ was found for each line or band of sufficient intensity. These measurements were carried out at -193 and +20°C. The results obtained (τ varied from 0.3 to 5.6 sec) are given in a table on p 661 and in Fig 2. The latter figure shows the luminescence and "relaxation" spectra at -193 and +20°C for three samples with 0.05, 0.35 and 2.89% of chromium. In the second series of experiments the temperature dependences of τ were measured in the region from 80 to 500°K for the strongest lines or bands. Simultaneously, the temperature dependences of the emission brightness

Card 2/3

SOV/51-6-5-16/34

Studies of the Spectral Distribution of the Luminescence Decay Time of Ruby, by the Pulse Taumeter Method

of these lines or bands were obtained. It was found that (1) ruby can have 7 to 8 different decay constants at various emission wavelengths from 690 to 800 mμ and (2) concentration of chromium affects strongly not only the absolute value of τ (which increases with increase of the amount of Cr) but also the temperature dependence of τ in the region 80-500°K. The experiments described here illustrate the possibilities of the pulse taumeter and show that ruby has an interesting but unknown, as yet, mechanism of energy transfer between emission centres. T.V. Kreytser took part in measurements. There are 3 figures, 1 table and 9 references, 6 of which are Soviet, 2 English and 1 German.

SUBMITTED: May 26, 1958

Card 3/3

24(4), 24(6)

AUTHOR: Tolstoy, N.A. SOV/51-6-5-17/34

TITLE: Formal Analysis of the Theory of Two-Step Excitation of Phosphorescence and Photoconductivity. (Formal'nyy analiz teorii dvukhstupenchatogo vozbuzhdeniya fosforestsentsii i fotoprovodimosti). III. Comparison of the Theory with Experiment (ZnS—Cu Emission). ((III. Sravneniye teorii s opytom (svecheniye ZnS-Cu))).

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 5, pp 665-671 (USSR)

ABSTRACT: The author and Shatilov discussed in preceding papers the possibility of two-step excitation of sulphide phosphors (Ref 1) and gave a formal analysis of the steady-state (Part I, Ref 2) and relaxation (Part II, Ref 3) processes in the two-step theory. The present paper describes a comparison of the two-step theory with the experimentally determined steady-state and relaxation properties of ZnS-Cu. It was found that the values of the parameters which lead to agreement between the theory and experiment were the same for the steady-state and relaxation properties. The steady-state emission and the initial stages of phosphorescence

Card 1/2

SOV/51-6-5-17/34

Formal Analysis of the Theory of Two-Step Excitation of Phosphorescence and Photoconductivity

decay of ZnS-Cu phosphors are essentially "pseudomonomolecular" processes, while the later stages of the afterglow suggest a "bimolecular" mechanism. There are 2 figures and 10 references, 9 of which are Soviet and 1 French.

SUBMITTED: May 9, 1958

Card 2/2

TOLSTOY, N. A., Doc Phys-Math Sci (diss) -- "New methods and results of investigating the kinetics of luminescence and photoconductivity". Leningrad, 1960. 32 pp (State Order of Lenin Optical Inst im S. I. Vavilov), 200 copies (KL, No 14, 1960, 125)

68699
S/051/60/008/02/028/036
E201/E391

24.7700

AUTHORS: Tolstoy, N.A. and Ryskin, A.I.

TITLE: Superlinearity in the Luminescence and Photo-conductivity Phenomena and the Rose-Bube Theory

PERIODICAL: Optika i spektroskopiya, 1960, Vol 8, Nr 2, pp 272 - 274 (USSR)

ABSTRACT: Experimental evidence indicating simultaneous superlinear dependence of luminescence and photo-conductivity on the excitation intensity E (Ref 1) makes it desirable to attempt a unified treatment of these phenomena. Since explanation of the superlinearity in photo-conductivity is easier, we shall consider it first. The change in photo-conductivity $\Delta\sigma_{\infty}$ is given by:

$$\Delta\sigma_{\infty} \sim E\beta\tau u \qquad (1)$$

where β is the quantum yield of electrons to the conduction band, τ is the carrier lifetime in the conduction band and u is the electron mobility. To explain the phenomenon of superlinearity it is necessary to assume that at least one of the three quantities

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E201/E391

Superlinearity in the Luminescence and Photo-conductivity Phenomena and the Rose-Bube Theory

β, τ or u rises with increase of E. Rose (Ref 5) and Bube (Ref 6) suggested that τ rises with E. From Rose and Bube's theory it follows that the initial rate of fall of the photo-conductivity should be strictly proportional to the excitation intensity E, i.e:

$$A\sigma'(0) \sim E \qquad (2).$$

To check Eq (2) the present authors carried out experiments on superlinear photo-resistors based on CdS. The authors used the electrical differentiation method described by Tolstoy (Ref 8). Light was modulated by interrupting focused light beams with bullets from small-bore rifles. The differentiated signal was recorded photographically by means of a pulse oscillograph (detailed description of the experiments will be given in a later communication). It was found that Eq (2) is not obeyed at all, that the dependence of $\Delta\sigma'(0)$ on E is superlinear and that $\tau(E)$ decreases slowly with rise of E. These results show that the main assumptions of the Rose-Bube theory are

Card2/3

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E201/E391

Superlinearity in the Luminescence and Photo-conductivity Phenomena and the Rose-Bube Theory

erroneous. On the other hand the results are in good agreement with the main ideas of the two-step theory (Refs 3,4) which assumes a rise of the quantum yield β with E . There are 9 references, 6 of which are Soviet and 3 English.

SUBMITTED: July 10, 1958

4

Card 3/3

TKACHUK, A.M.; TOLSTOY, N.A.

Luminescence of ethanolamine compounds of platinum. Opt. i spektr. 9 no.2:261-264 Ag '60. (MIRA 13:8)
(Luminescence) (Platinum compounds)

TOLSTOY, N.A.

Ninth Conference on Luminescence (crystal phosphors). Opt. i spektr. 9 no.2:277-279 Ag '60. (MIRA 13:8)
(Luminescence--Congresses)

83371
S/051/60/009/003/010/011
E201/E691

26.1512

AUTHORS: Sokolov, V.A. and Tolstoy, N.A.

TITLE: Luminescence 21 of Thallium Chloride 21

PERIODICAL: Optika i spektroskopiya, 1960, Vol. 9, No. 3, pp. 421-423

TEXT: The authors investigated luminescence of thallium chloride monocrystals in an atmosphere of pure helium. Monocrystals were grown by a modified Stockbarger method in sealed Pyrex ampoules. The initial powder (used to grow monocrystals) was recrystallized twice in very pure distilled water and heated in vacuum for 3-4 hours at 200-220°C. Test samples of 1.5 x 10 x 15 mm dimensions and 100 g weight were cut from monocrystals. They were polished with a piece of flannel soaked in an aqueous solution of thallium chloride and dried in vacuum for 2-3 hours at 110°C. Preparation of the samples was carried out using exclusively red illumination ($\lambda > 600$ mμ). Luminescence was excited with a mercury line of $\lambda = 365$ mμ from an SVDSh-250 lamp. A monochromator UM-2 was used and the spectral distribution of intensity was recorded with a photomultiplier FEU-22 and a microammeter M-95. During measurements the samples were kept in an atmosphere of pure helium and all heat treatments were carried

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83371

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E201/E691

Luminescence of Thallium Chloride

out in darkness. The following results were obtained. Blue luminescence (a 55 mμ wide band at 460 mμ; Fig. a, curve 1) was observed in pure crystals. It was due to structural defects whose density depended on thermal history of the crystals. A band with a maximum at 620 mμ (Fig. б, curve 1) was produced by plastic deformation. A band with a maximum at 740 mμ appeared after heating in dry pure helium (1-10 mm Hg) at 250-350°C; it was due to loss of chlorine. Illumination with ultraviolet light (365 mμ) above -150°C reduced luminescence intensity (Fig. a, curve 2) in contrast to heating in darkness which intensified luminescence. This contradicts conclusions reported by Vysochanskiy (Refs. 3, 4). Recovery of the ability to luminesce of samples de-excited by ultraviolet illumination occurred probably due to decomposition of quenching centres by heating in darkness. Continuation of this work will be reported later. There are 2 figures and 7 references: 2 Soviet, 3 English, 1 German and 1 translation into Russian.

4

SUBMITTED: April 16, 1960

Card 2/2

TOLSTOY, N.A.; LYU SHUN'-FU [Liu Shun-fu]

Relaxation spectrum of cyanite. Opt. i spektr. 9 no. 6:787-790 D '60. (MIRA 14:1)

(Kyanite--Spectra)

TOLSTOY, N.A.; TKACHUK, A.M.; RYSKIN, A.I.

Flare luminescence. Part 3: Effect of the intensity of exciting and de-exciting light. Opt. i spektr. 10 no.2:220-224 F '61.
(MIRA 14:2)

(Luminescence)

20836

9.4160
24.3500 (1137,1138, 1395)

S/048/61/025/003/025/047
B104/B214

AUTHORS: Tolstoy, N. A. and Sokolov, R. A.

TITLE: Luminescence of thallium chloride single crystals

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 3, 1961, 375-376

TEXT: This paper was read at the Ninth Conference on Luminescence (Crystal Phosphors) held in Kiyev from June 20 to June 25, 1960. The spectral composition and the intensity of luminescence of single crystals of thallium chloride were studied after different treatments of the crystals which were bred by the authors themselves. The luminescence was excited by light of wavelength 365 mμ at the temperature of liquid nitrogen; the measurement of the specimens was done in a helium atmosphere. It turned out that thallium chloride has three luminescence bands: 1) a blue band with the maximum at about 460 mμ (Fig. 1, Curve 1); 2) an orange band with the maximum near 620 mμ; 3) a dark-red band with the maximum at 740 mμ. The blue band appears immediately after breeding; the orange band appears after plastic deformation (Fig. 1, Curve 2),

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20836

Luminescence of thallium... S/048/61/025/003/025/047
B104/B214

and the dark-red band after a heat treatment of the specimens in a pure He atmosphere (Fig. 1, Curve 3). Long exposure to ultraviolet light (λ = 365 mμ) at temperatures lower than -150°C did not lead to any remarkable change in luminescence. At higher temperatures, the intensity of the whole spectrum decreased. In this case, the blue luminescence was extinguished more quickly than the luminescence of longer wavelengths (Fig. 1, Curve 4). Measurements of the intensity of luminescence I in the maximum of the blue band as a function of the time of exposure to light of wavelength 365 mμ showed that I decreases hyperbolically with an increase of t according to the rule $I = I_0/(1+At)$. Here, I_0 is the initial intensity and A a constant depending on the temperature and intensity of irradiation. By a parallel measurement of the light transmittance of the Hg line with λ = 436mμ, it was found that in this spectral range the transmittance after the exposure does not change markedly (Fig. 2). Therefore, the weakening of the observed luminescence cannot be explained as a "filter effect". The decrease of intensity on exposure is a reversible process: By aging the exposed specimen in the dark, luminescence is restored almost completely. The restoration of luminescence

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is accelerated at higher temperatures. It can be assumed that the lattice defects are the centers of blue luminescence. The orange luminescence band with its maximum near 620 mμ results from mechanical defects (dislocations); this agrees with assumptions made in other paper. The dark-red band is evidently caused by the impoverishment of the crystals in chlorine. Possibly an electron from the escaped chlorine atom fills this place and forms an F-center. There are 2 figures and 3 references: 1 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: Randall I. T.. Trans. Faraday Soc., 35, 6 (1939).

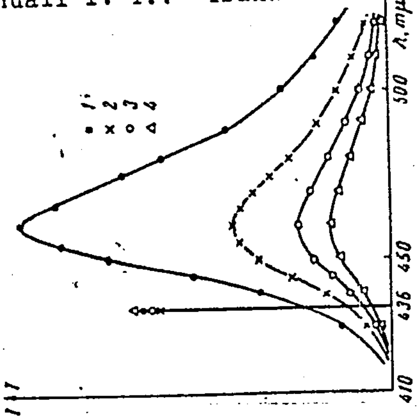

Рис. 2

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B104/B214

Luminescence of thallium...

Legend to Fig. 1: Luminescence spectrum of thallium chloride after different treatments of the crystal.
Legend to Fig. 2: Change of the luminescence spectrum and the transmission spectrum of the Hg line with λ = 436 mμ at the temperature of liquid nitrogen after exposing the crystal to light of wavelength 365 mμ at room temperature. 1) Before exposure; 2) After exposure for 5 seconds; 3) After a further exposure for 5 seconds; 4) After still another exposure for 5 seconds.

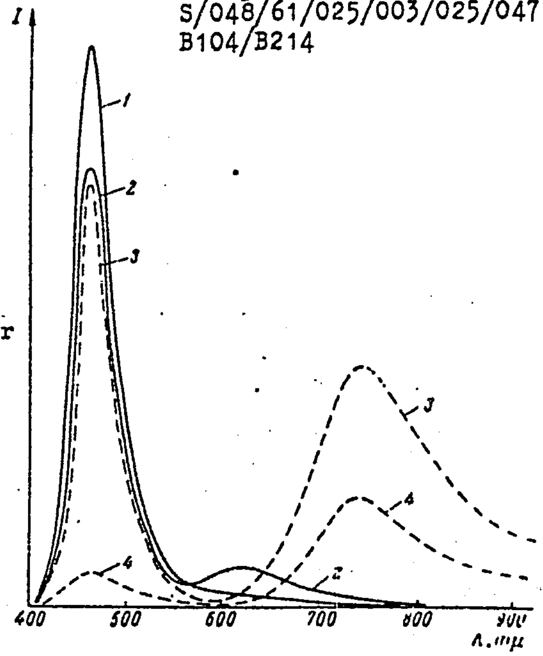

Рис. 1

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20846

S/048/61/025/003/035/047
B104/B202

9.4160 (also 1137,1395)

AUTHORS: Tolstoy, N. A., Tkachuk, A. M., Sokolov, V. A., Burlakov, A. V., Ryskin, A. I., Mansurova, Z. S., and Yepifanov, M. V.

TITLE: Flash-heating of ZnS-phosphors and concurrence of luminescence bands

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, v. 25, no. 3, 1961, 399-405

TEXT: This paper was presented at the 9th conference on luminescence (crystal phosphors), Kiyev, June 20 to 25, 1960. Flash heating of phosphors is related to an accumulation of electrons or holes which occurs in the interval between two excitations. Proceeding from the scheme suggested by Schön and Klasens the authors discuss the processes occurring in this connection with the aid of the scheme shown in Fig. 1. They explain the filling of the blue and red luminescence centers with holes in the case of steady excitation. They also discuss the mechanism of flash heating which leads to the concurrence of blue and red bands which had been described

3

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B104/B202

Flash-heating of ZnS-phosphors...

already by V. L. Levshin. On the basis of these considerations the authors study the dependence of the steady luminescence of short-wave bands on the intensity of the exciting light at different temperatures. Fig. 1 graphically shows the results obtained for different temperatures. In Fig. 1a which holds for very low temperatures, the intensity of red luminescence is represented as a linear function of energy. Fig. 1b which approximately holds for room temperature shows that red luminescence has one constant component and one component depending linearly on E. For some tens of degrees (Fig. 1c) the intensity of the red luminescence depends already nonlinearly on E. It becomes linear again only in the range of 100°C. This characteristic dependence of luminescence on the intensity of the exciting light at different temperatures is essentially explained by the filling of the first and second localization level which depends on temperature and intensity. Fig. 3 shows experimental results. It could be demonstrated already earlier that the curves of flash heating of the blue and red bands are opposite i.e., if one hole migrates off a blue center, a loss of a "blue quantum" occurs, if, however, a hole migrates to a red center, a "red quantum" is emitted. As could be proven, this process is specific and does not always apply. The experimental results

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20846
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B104/B202

Flash-heating of ZnS-phosphors...

shown in Fig. 4 clearly show a parallelism. In the phosphors studied here red and blue luminescence occur "additively" and "concurrently". There are 5 figures and 9 references: 7 Soviet-bloc and 2 non-Soviet-bloc.

Legend to Fig. 1: 1) conduction band 2) electron adhesion level 3) red centers 4) blue centers. A_1 and A_2 hole levels of first and second localization.

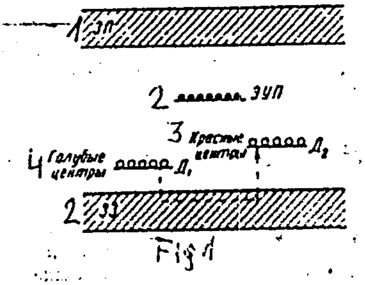

Fig 1

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B104/B202

Flash-heating of ZnS-phosphors...

Legend to Fig. 2: theoretical dependence of steady luminescence of the long-wave bands on the intensity of exciting light.

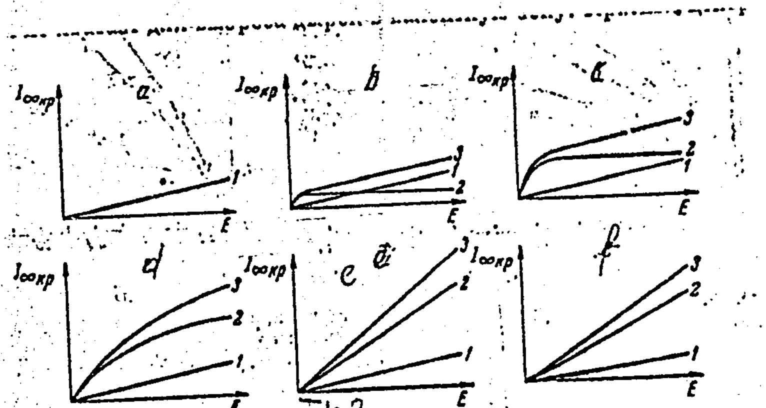

Fig 2

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B104/B202

Flash-heating of ZnS-phosphors...

Legend to Fig. 3: Experimental dependence of steady luminescence of the long-wave bands on the intensity of exciting light a) ZnS-Mn phosphor ($7.5\cdot10^{-4}$ g/g Mn) б) ZnS-Ag,Ni phosphor ($5\cdot10^{-3}$ g/g Ag, 10^{-5} g/g Ni)

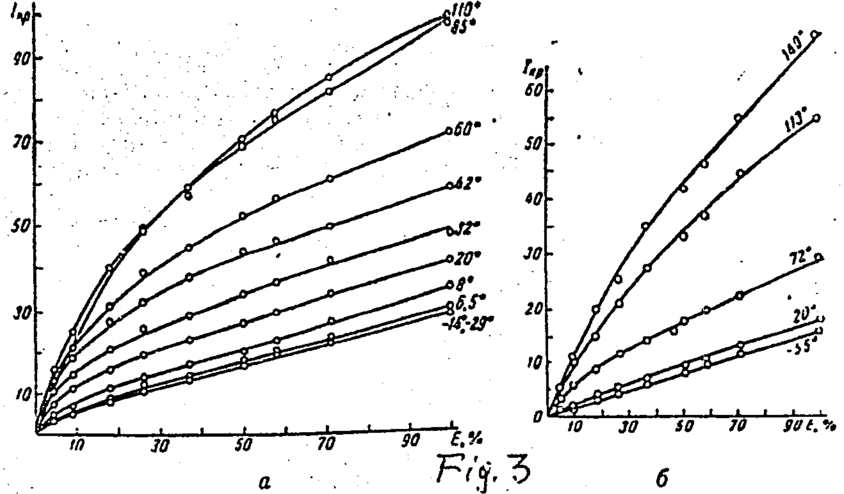

Fig. 3

a

б

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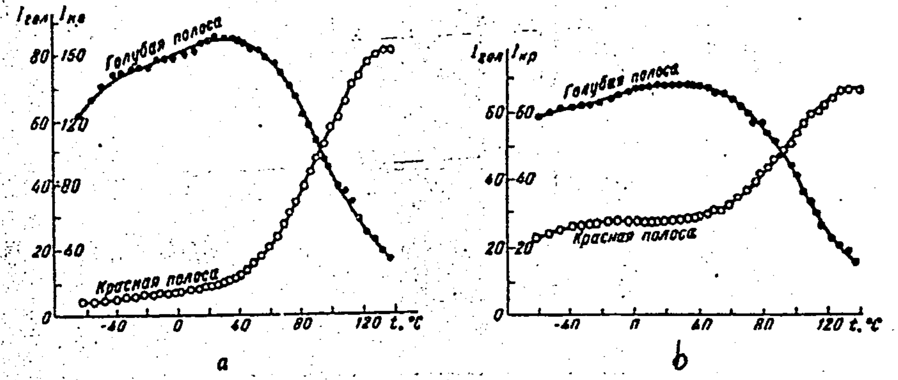
B104/B202

Flash-heating of ZnS-phosphors...

Legend to Fig. 4: temperature dependence of steady luminescence of the blue and red bands a) ZnS-Ni b) ZnS-Ag,Ni c) ZnS-Ag,Co,Ni black points: blue bands, circles: red bands



Card 6/7

Flash-heating of ZnS-phosphors...

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B104/B202

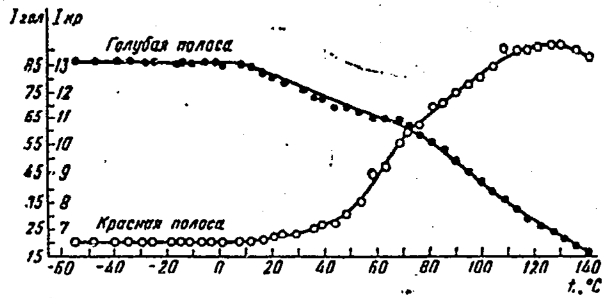

Fig. 4

C.

Card 7/7

39868
S/051/62/013/002/007/014
E202/E492

24.3500 (also 4205)

AUTHORS: Tolstoy, N.A., Shun-fu, Lyu, Lapidus, M.Ye.

TITLE: Luminescence kinetics of chromium luminophors
III. Ruby, Part I, Luminescence spectra and
relaxation spectra, effect of chromium concentration
and thickness

PERIODICAL: Optika i spektroskopiya, v.13, no.2, 1962, 242-249

TEXT: Using high purity (less than 0.001% heavy metals contaminants) alumina as starting material, the authors prepared polycrystalline samples of synthetic rubies in order to include high concentration (8% Cr_2O_3) of chromium. The samples were baked at 1250 to 1300°C for 2.5 hours without any substantial loss of chromium. The luminescence spectra investigated on the above samples at -180°C gave broadly the same results as those previously given by A.L.Schawlow, D.L.Wood and A.M.Clogston (Phys. Rev. Lett., no.3, 1959, 271). Relative to the R-line long wavelength, part of the luminescence spectrum was found to be connected partly with the luminescence of the interacting pairs of chromium ions "dimers", and partly due to luminescence of groups of more than two ions "polymers". The relative intensity of the

X

Card 1/3

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E202/E492

Luminescence kinetics ...

dimeric and polymeric luminescence depended in a superlinear way on the concentration of chromium - for the polymeric luminescence (diffused IR band) the superlinearity was expressed much more sharply than for the dimeric. A particularly great role was played by the reabsorptive phenomena which deform the relaxation as well as the luminescence spectra when insufficiently thin samples were used. It was also found that not only did the relative intensity increase towards the long wavelengths with the concentration of Cr and the finite thickness of the sample but also the ratio of the R_1/R_2 of the principal doublet depended on the thickness of the sample. The relaxation luminescence spectra of fine powdered synthetic rubies without and with additions of Cr_2O_3 ranging from 0.055 to 8% wt, and observed at -180 and 20°C, made the authors conclude that it is possible to isolate 6 groups of lines and bands with different quenching times τ and that these groups agree substantially with the data given previously (Optika i spektroskopiya, no.5, 1959, 659). In additional series of experiments it was also confirmed that the intensity of luminescence was linearly dependent on the intensity of excitation E and that there was no dependence of relaxation

Card 2/3

S/051/62/013/002/007/014
E202/E492

Luminescence kinetics ...

time on E. There are 2 figures and 4 tables.

SUBMITTED: May 8, 1961

X

Card 3/3

24.2600

3895 0
S/181/62/004/007/031/037
B178/B104

AUTHORS: Tolstoy, N. A., Osipov, B. S., and Fomin, G. A.

TITLE: Change in sign of the photo-emf of cuprous oxide

PERIODICAL: Fizika tverdogo tela, v. 4, no. 7, 1962, 1966-1967

J

TEXT: The change in sign of the photo-emf of Cu_2O was detected by using the pulsed capacitor method. The advantage of this method lies in the fact that the photo-emf can be regarded as resulting from a single excitation of the substance by single pulses in the absence of a residual excited state. The existence of a residual excitation is particularly marked at low temperatures. At room temperature, Cu_2O has a p-type photo-emf which decreases continuously with dropping temperature. An n-type photo-emf appears between -40 and -80°C and increases rapidly with decreasing temperature. At -180°C, the pulse of the n-type photo-emf is 10 to 20 times stronger than that of the p-type photo-emf, and 2 to 5 times stronger than the p-type pulse at room temperature. As the p-type pulse lasts longer, it is possible to observe both pulses at the

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Change in sign of the photo-emf ...

S/181/62/004/007/031/037
B178/B104

same time. The relation between the amplitudes of the p- and n-type photo-emf depends on the wavelength of the exciting light. At room temperature and in red or UV light only an n-type photo-emf exists.

ASSOCIATION: Gosudarstvennyy opticheskiy institut im. S. I. Vavilova Leningrad (State Optical Institute imeni S. V..Vavilov, Leningrad)

SUBMITTED: March 21, 1962

Card 2/2

TOLSTOY, N.A.; KHIL'KO, G.I.; RYSKIN, A.I.; TRUSOV, A.A.

Relation between luminescent and photoelectric phenomena in ZnS-Mn. Fiz. tver. tela 4 no.11:3177-3184 N '62. (MIRA 15:12)

1. Gosudarstvennyy opticheskiy institut imeni S.I. Vavilova, Leningrad.
(Luminescent substances)
(Photoelectricity)

38379

24.3500

S/070/62/007/003/006/026
E132/E460

AUTHOR: Sokolov, V.A., Tolstoy, N.A.

TITLE: Single crystals of the halides of thallium and certain of their properties

PERIODICAL: Kristallografiya, v.7, no.3, 1962, 389-393

TEXT: Crystals of specially pure TlCl and TlBr were grown by D. Stockbarger's method (J. Opt. Soc. Amer., v.39, 1949, 731). The crystals were grown in sealed pyrex glass ampules, the materials having been outgassed under vacuum at 170 to 200°C for 4 to 5 hours. A diagram of the apparatus is given. Their luminescence properties were studied. It was found that short wavelength luminescence is a property of these compounds in the crystalline state when the number of defects is a minimum. Long wavelength luminescence is connected with the presence of mechanical defects and an increase at the long wavelength end of the spectrum is accompanied by a decrease at the other end. The luminescence was measured at liquid nitrogen temperature after annealing at 250°C. There are 6 figures.

SUBMITTED: June 9, 1961

Card 1/1

S/051/62/013/001/010/019
32609
E039/E420

24.3500

AUTHORS: Tolstoy, N.A., Liu Shun-fu

TITLE: Luminescence kinetics of chromium luminescents
II. Gallium oxide: relaxation spectra, reabsorption

PERIODICAL: Optika i spektroskopiya, v.13, no.1, 1962, 112-117

TEXT: Data are derived on relaxation spectra of gallium oxide activated with chromium at different concentrations of chromium and at different temperatures. It is shown that at -180°C the relaxation time τ is independent of the concentration of Cr_2O_3 up to values of 0.3% ($\tau \approx 2.0 \times 10^{-3}$ sec). For higher concentrations τ decreases; at 3.0% Cr_2O_3, $\tau = 0.04 \times 10^{-3}$ sec for wavelengths of 688.6 to 731 mμ. At 20°C, τ is independent of concentration of Cr_2O_3 for values up to 1% ($\tau \approx 0.14 \times 10^{-3}$ sec) and falls to a value of 0.03×10^{-3} sec for 3.0% Cr_2O_3. The variation of τ with temperature practically coincides for all concentrations of Cr_2O_3 up to 1% and as the above figures show there is practically no dependence on temperature for 3% Cr_2O_3. The connection between spectral and relaxation laws in Ga_2O_3-Cr

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X

S/051/62/013/001/010/019
E039/E420

Luminescence kinetics ...

is discussed. Reabsorption effects are examined by making measurements on samples of thickness 50 to 70 μ and 120 to 260 μ. It is shown that for concentrations of up to 0.3% Cr_2O_3 the value of τ is practically unaffected, but for concentrations of 1 to 3% Cr_2O_3 the value of τ is ≈30% greater for the thicker samples. In the latter case the relaxation spectrum is also changed. It is suggested that work is necessary on very thin samples in order to obtain undistorted spectral and relaxation data. There are 2 figures and 1 table.

SUBMITTED: April 29, 1961

Card 2/2

39688

S/051/62/013/001/009/019
E039/E420

24.3500

AUTHORS: Tolstoy, N.A., Liu Shun-fu

TITLE: Relaxation spectra of uranium activated alkali and alkali earth metal fluorides

PERIODICAL: Optika i spektroskopiya, v.13, no.1, 1962, 107-111

TEXT: Preliminary data on relaxation spectra are determined for CaF_2-U, SrF_2-U and BaF_2-U and also single crystals of LiF-U and NaF-U by means of a pulse technique and compared with normal luminescence spectra. It is shown that the rare earth fluorides activated with uranium MeF_2-U decay at different rates at different parts of the spectrum. For CaF_2-U at -175°C there are three relaxation times τ: 1.8×10^{-4}, 2.3×10^{-4} and $(2.8 \text{ to } 2.9) \times 10^{-4}$ sec. At room temperature $\tau = (0.9 \text{ to } 1.0) \times 10^{-4}$ sec for the whole spectrum. For SrF_2-U at -178°C there are two values of τ: $(2.0 \text{ to } 2.2) \times 10^{-4}$ and $(2.5 \text{ to } 2.6) \times 10^{-4}$ sec. At room temperature the luminescence of SrF_2-U is strongly quenched $\tau < 10^{-5}$ sec. For BaF_2-U

X

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S/051/62/013/001/009/019
E039/E420

Relaxation spectra ...

at -180°C there are four values of τ and at room temperature the luminescence is completely quenched. In general, the long wavelength luminescence decays more slowly than the short wavelength. In the case of LiF-U and NaF-U the difference in values of τ is more significant than for the MeF_2-U group. For LiF-U, τ varies by a factor of 4 and in NaF-U by a factor of 10. As before, the long wavelength luminescence decays more slowly than the short wavelength. At concentrations of uranium of 10^{-4} g/g eq. the relaxation of nearly all the spectral lines is practically exponential and as the uranium concentration is increased the relaxation deviates from the exponential.
This paper was presented at the 9th Conference on Luminescence at Kiyev (July 1960).
There are 2 figures and 1 table.

X

SUBMITTED: April 29, 1961

Card 2/2

S/051/62/012/006/008/020
E075/E436

AUTHORS: Tolstoy, N.A., Liu Shun-fu

TITLE: Kinetics of glow of chromium luminophors.
I. Gallium oxide. 1st part.
Method: Temperature and concentration dependence of glow spectra

PERIODICAL: Optika i spektroskopiya, v.12, no.6, 1962, 738-745

TEXT: The authors initiated a broad study of relaxation spectra of a number of luminophors activated with Cr. The present work is devoted to Ga_2O_3. The glow spectra were obtained by the excitation of the samples with an impulse source in the ultraviolet (> 330 millimicrons) and visible region. Samples of $Ga_2O_3 \cdot Cr$ in a powdered form were prepared by Foster-Stumpf method (J. Amer. Chem. Soc., v.73, 1951, 1590) with Cr concentrations of 0.01, 0.03, 0.1, 0.3, 0.6, 1 and 3%. It was shown that α-$Ga_2O_3 \cdot Cr$ does not glow when subjected to photo- or cathode-excitation, whilst β-$Ga_2O_3 \cdot Cr$ gives a bright glow with spectrum lines agreeing completely with the lines given by Deutschbein. It was thus shown that Deutschbein's isomorphism principle is not correct

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Kinetics of glow ...

S/051/62/012/006/008/020
E075/E436

for β-Ga_2O_3. Spectra of the samples with 0.03, 0.3% Cr are practically the same and are characterized by the main doublet with components R_1 (696 mμ) and R_2 (688 mμ). In the samples containing 0.6% Cr, two additional lines appear at 696.8 and 698.3mμ. The intensity of these lines increases rapidly with the concentration of Cr. A very characteristic property of the samples containing 3% Cr is the appearance at -180°C of a bright diffuse glow in the infrared part of the spectrum. The glow spectra becomes more diffuse with the increasing temperature and the maxima of the lines shift towards the longer wavelengths. The total glow at room temperature is, if anything, stronger than it is at the lower temperature. Heating to 160°C of the samples with 1% Cr showed no quenching effect but the longer-wave and antistoke regions of the spectra became more intense at the cost of the glow in the region of the main doublet. Thus the long-wave glow is thermally activated. There are 7 figures and 1 table.

SUBMITTED: April 29, 1961

Card 2/2

39873
S/051/62/013/002/013/014
E032/E514

24,3160

AUTHORS: Tolstoy, N.A. and Yepifanov, M.V.

TITLE: A multilamp source of modulated light for a pulse taumeter

PERIODICAL: Optika i spektroskopiya, v.13, no.2, 1962, 291-294

TEXT: The authors describe a multilamp modulator. Sixty pulsed lamps of type ИФК-120 (IFK-120) are arranged on the periphery of a disc which revolves with an angular velocity of 10 r.p.m. Each lamp gives rise to a flash each time it passes through the focus of the parabolic quartz condenser. This is equivalent to a source of light producing 10 pulses/sec. Each of the lamps remains inactive for 6 sec after producing the flash, which corresponds to the normal single-shot operating conditions. The lamps are fired by discharging 1300 μF capacitors through them, the capacitors being charged by a germanium rectifier to 300 V each. The capacitors rotate together with the lamps and contact is made through special brushes. Provision is made for the adjustment of the "phase" of the rotating disc, i.e. the position

X

Card 1/2

A multilamp source of ... S/051/62/013/002/013/014
E032/E514

of the lamps relative to the optical axis of the condenser. There are 2 figures. X

SUBMITTED: March 6, 1962

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L 18747-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD/JG S/2941/63/001/000/0160/0167

ACCESSION NR: AT3002212

56

AUTHORS: Sokolov, V. A.; Tolstoy, N. A.

TITLE: The nature of luminescence in thallium chloride

SOURCE: Optika i spektroskopiya; sbornik statey. v. 1: Lyuminestsentsiya. Moscow. Izd-vo AN SSSR. 1963. 160-167

TOPIC TAGS: luminescence, electronic transition, colloid, emission band

ABSTRACT: The authors have analyzed two theories put forth to explain the nature of luminescence in thallium chloride. The first, by H. Gobrecht and F. Becker (Zs. Phys., 5, 553, 1953) attributes blue radiation of TlCl to microquantities of water in a TlCl specimen playing the role of activator of blue luminescence. The red emission band is considered to be the result of a mechanical defect. The second, by A. S. Vy*sochanskiy (Kand. diss., Odessa, 1953; DAN SSSR, 112, 228, 1957), attributes the blue luminescence band to electronic transition in single hyperstoichiometric thallium atoms, and the red band to thallium atoms entering the colloidial state. Several sets of experiments were performed in which the effects of water, Cl_2, and Tl are studied independently on thallium chloride in

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L 18747-63
ACCESSION NR: AT3002212

vacuum. The results refute all above theories except the red band assumption of Gobrecht and Baker, which is attributed to defects in the crystal structure. Orig. art. has: 7 figures.

ASSOCIATION: none

SUBMITTED: 23May62 DATE ACQ: 19May63 ENCL: 00

SUB CODE: PH NO REF SOV: 010 OTHER: 004

Card 2/2

L 19481-63 EWT(1)/EWP(q)/EWT(m)/EWP(B)/BDS AFFTC/ASD/IJP(C)/SSD JD

S/2941/63/001/000/0257/0260

76B

ACCESSION NR: AT3002230

AUTHORS: Ryskin, A. I.; Tolstoy, N. A.

TITLE: Excitation energy transfer mechanism in ZnS-Mn phosphors

SOURCE: Optika i spektroskopiya; sbornik statey. v. 1: Lyuminestsentsiya. Moscow, Izd-vo AN SSSR, 1963, 257-260

TOPIC TAGS: excitation, interaction, dipole transition, orange band, absorption

ABSTRACT: The energy transfer process of Mn^{2+} ions in ZnS-Mn has been studied. The assumption is made that at low temperatures this excitation energy occurs in blue centers (spots) lying on the periphery of interaction with the Mn^{2+} ions. The radius of this interaction, R$_k$, is designated as the ratio of orange band intensity (produced by Mn^{2+} ions) to the integrated light intensity. Values of R$_k$ are tabulated for various annealed phosphor specimens. It is shown that dipole-dipole energy transitions between blue centers exists only in a region of 2Å. Apart from dipole-dipole energy transitions, probability of interchange transitions depends on the extent of blue centers; large magnitudes of the latter being compensated for by small magnitude, overlapping, integrated spectra of radiation and absorption. A calculation is made of the distance R between blue centers and

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L 19481-63

ACCESSION NR: AT3002230

blue center concentration in ZnS. It is found that contacting blue centers (R≥24Å) start at a concentration level C = 0.3%. The authors contend that a large concentration of blue centers is necessary to allow interchange interactions to occur. Orig. art. has: 2 tables.

ASSOCIATION: none

SUBMITTED: 20Jun62	DATE ACQ: 19May63	ENCL: 00
SUB CODE: PH	NO REF SOV: 007	OTHER: 008

Card 2/2

TOLSTYKH, V.I., inzh.

Determining the economic efficiency of capital investments and calculation of renovation deductions. Trudy MIIT no.173:104-118 '63. (MIRA 17:9)

S/051/63/014/001/009/031
E039/E120

AUTHORS: Tolstoy, N.A., and Liu Shun-fu

TITLE: Luminescence kinetics of chromium luminophors.
V. Beryllium spinel activated with chromium

PERIODICAL: Optika i spektroskopiya, v.14, no.1, 1963, 49-56

TEXT: Data are presented on the temperature and concentration dependence of the luminescence and relaxation spectra of beryllium spinel activated by chromium. $BeAl_2O_4$ - Cr is prepared in powder form with concentrations of 0.1, 0.5 and 1% Cr, and measurements were made on samples 100 μ thick. At -180 °C and for 0.1% Cr the main doublet is observed, also the 682.3 mμ line and the weak 697.7 mμ N line. For the 0.5% Cr sample the intensity of the N line is sharply increased and on both sides of it a series of new lines appear. At 1% Cr the intensity of the N and other secondary lines is increased again. There are three basic parts to the spectra at low temperatures: a) the main doublet radiated from separate Cr centres - "monomers"; b) N-lines and other lines from 682.3 to 743.1 mμ resulting from the "dimer" form of Cr ions; and c) infrared bands depending on the "polymer" form of Cr

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Luminescence kinetics of chromium.. S/051/63/014/001/009/031
E039/E120

centres. At 20 °C the spectra have a different form; firstly, on the short wavelength side of the doublet is a well developed anti-Stokes region; secondly, the long wavelength part loses its sharp structure; and, thirdly, the concentration variation is quite different from that at -180 °C. An examination of relaxation spectra at -180 °C shows that the most characteristic feature in a number of cases is the non-exponential relaxation law. The interpretation of these dependences is based on a comparison of the different nature of the luminescence centres responsible for the different parts of the radiated spectra.
There are 4 figures and 2 tables.

SUBMITTED: November 11, 1962

Card 2/2

45085

24.3500

S/051/63/014/001/027/031
E039/E120

AUTHORS: Tolstoy, N.A., Tkachuk, A.M., and Ageyeva, L.Ye.

TITLE: Some manifestations of the non-molecular excitation mechanism of platinocyanides

PERIODICAL: Optika i spektroskopiya, v.14, no.1, 1963, 163-165

TEXT: Platinocyanides excited at liquid nitrogen temperature and subsequently heated at 0.6 deg/sec attain maximum thermoluminescence at ~120 °K. The estimated depth of level is derived from the formula:

$$U = k\,T^2_{max})/\,\delta$$

where δ is the half width of the peak given in the table. Water of crystallisation is shown to have no effect on thermoluminescence. The dependence of relaxation time τ on the intensity of excitation E is investigated. Using the mechanical ultra-taumeter method it was found that τ does not depend on E. By using the pulsed ultra-taumeter method (i.e. with a pulsed ultraviolet lamp ИС-3 (IS-3)) an excitation density of 10^{17} quanta/cm2 is attained. In this case in the "normal" regime of excitation τ remains

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Some manifestations of the ...

S/051/63/014/001/027/031
E039/E120

constant but on increasing the excitation density to maximum τ begins to decrease with increase in E. The value of τ differs by 25-30% for different salts. The decrease in τ with increase in E occurs at room temperature as well as at liquid nitrogen temperature. The absence of photoconductivity and photo-e.m.f. is typical for pure monomolecular mechanisms. Photoelectric effects investigated using a Bierman condenser and a pulsed lamp ИФК-120 (IFK-120) with a УФС-1 (UFS-1) filter showed that platinocyanides give a well defined diffusion photo-e.m.f. signal. Electron and hole effects are observed. These effects clearly show the monomolecular mechanism of excitation and relaxation in platinocyanides.

There is 1 table.

SUBMITTED: July 2, 1962

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Some manifestations of the ... S/051/63/014/001/027/031
E039/E120

Table

Composition of salt	T_{max}, °C	δ, °C	U, eV
$Li_2[Pt(CN)_4]\cdot 4H_2O$	-144	29	0.05
$Li_2[Pt(CN)_4]\cdot xH_2O$[1]	-152	29	0.04
$K_2[Pt(CN)_4]\cdot 3H_2O$	-158	38	0.03
$Ba[Pt(CN)_4]\cdot 4H_2O$	-146	16	0.08
$Mg[Pt(CN)_4]\cdot 4H_2O$	-146	30	0.045

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L 10180-63 EWT(l)/EWP(q)/EWT(m)/BDS/EEC(b)-2--
AFFTC/ASD/SSD--CG/WH/IJP(C)/EH
ACCESSION NR: AP3000587 S/0051/63/014/005/0691/0699

62
6 61

AUTHOR: Tolstoy, N. A.; Abramov, A. P.

TITLE: Kinetics of emission of chromium luminophors 2 VII. The ruby 6 (Part 3) On the interaction of chromium ions. Steady-state emission

SOURCE: Optika i spektroskopiya, v. 14, no. 5, 1963, 691-699

TOPIC TAGS: luminescence of ruby

TEXT: The seventh article in a series on the kinetics of emission of chromium luminophors reports the results of quantitative studies of the ratio of steady-state emission intensity of side lines ("dimer" emission) to main doublet emission intensity ("monomer" emission) in finely powdered ruby (microcrystals grown from solutions) having various Cr concentrations. This ratio increases with concentration, first linearly and then "superlinearly." The intensity of the linear section can be explained on the basis of dimer "density" theory only if it is assumed either that the absorption of the excitation light is 10 times greater for dimers than for monomers or that the number of dimers is 10 times greater than statistically

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L 10180-63
ACCESSION NR: AP3000587

predicted. Analysis of the superlinear section shows sensitization of the dimers by the monomers, beginning at 0.25% Cr concentration. This sensitization decreases with increased temperature. An alternate explanation of the linear and superlinear sections, based on dimer properties, is offered. Monomer emission of the ruby is shown to have an extension into the long-wave region. The emission from this region increases with increased temperature. "The authors warmly thank P. P. Feofilov for his valuable discussions." Orig. art. has: 5 figures, 5 formulas, and 1 table.

ASSOCIATION: none

SUBMITTED: 20Jul62	DATE ACQ: 12Jun63	ENCL: 00
SUB CODE: 00	NO REF SOV: 007	OTHER: 000

Card 2/2

S/051/63/014/003/008/019
E039/E120

AUTHORS: Tol~~stoy, N.A.~~, and Liu Shun-fu

TITLE: Luminescence kinetics of chromium luminophors. VI. Composite $Al_2O_3 \cdot Ga_2O_3$-Cr system and magnesium spinel activated by chromium

PERIODICAL: Optika i spektroskopiya, v.14, no.3, 1963, 378-382

TEXT: The effect of structure and deformation of the crystal lattice on the luminescent and relaxation spectra of mixed crystals of oxides of aluminium and gallium activated by chromium $(Al_xGa_{100-x})_2O_3$-Cr is investigated. This has a β-Ga_2O_3 type lattice for x = 0 to 59% and α-Al_2O_3 type lattice for x = 80 to 100% in the samples used. The Cr concentration is 0.4%. For x = 80% the dependence of the relaxation time τ_R on absolute temperature levels off to a plateau at low temperatures ~100 °K with an activation energy of 0.16 eV. With x = 59% the plateau is shortened and the activation energy is 0.11 eV. For pure β-Ga_2O_3-Cr the activation energy is 0.063 eV and at higher

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Luminescence kinetics of chromium... S/051/63/014/003/008/019
E039/E120

temperatures the activation energy is increased. Data are presented on the spectral and relaxation properties of Mg spinel activated by chromium ($MgAl_2O_4$-Cr). This is characterized by a markedly non-exponential relaxation law. At room temperature the relaxation time is about 7×10^{-5} sec, while at 100 °K it is about 10^{-2} sec.
There are 3 figures and 1 table.

SUBMITTED: November 11, 1961

Card 2/2

RYSKIN, A.I.; TOLSTOY, N.A.; KHIL'KO, G.I.

Flashlike rise of luminescence. Part 4. Opt. i spektr. 15 no.5: 659-666 N '63. (MIRA 16:12)

TOLSTOY, N.A.; TKACHUK, A.M.

Ultra-taumeter with a pulse tube. Opt. i spektr. 15 no.5:698-704
N '63. (MIRA 16:12)

TOLSTOY, N.A.; YEPIFANOV, M.V.

Shape of the light pulse emitted by a flash lamp. Opt. i spektr. 16 no. 4:677-683 Ap '64. (MIRA 17:5)