

BEREZIN, B. P.

GRANSKIY, Viktor Isidorovich; BEREZIN, B.P., nauchnyy redaktor; VOLOSHIN, D.A., redaktor

[What the foundry worker should read; a bibliography] Chto chitat' rabochim litelnogo proizvodstva; rekomendatel'nyi ukazatel' literatury. Nauchnyi red. B.P.Berezin. Leningrad, Gos. publichnaya biblioteka im. M.E. Saltykova-Shchedrina, 1957. 95 p. (MLA 10:10)
(Bibliography--Founding)

BEREZIN, B. P.

BEREZIN, B. P.

6641 BEREZIN, B. P., SPETSALIZIROVANNYE I KOOPERIROVANNYE
METALLODNABAVYAYUSHCHIY PREDPRIVATNY PROMYSLOVOY KOOPERATSYI.
M., KOIS, 1954 132 S. S. ILL. 22 SH 3000 BRZ 4 R 60 K
(55-2330) 334.6: 672 plus 672

SO: KNIZHNYA LETOPIS' NO. 6, 1955

~~BEREZIN~~, Boris Mikhaylovich; PASYNKOV, V.V., prof., doktor tekhn.nauk,
otv.red.; VARKOVITSKAYA, A.I., red.; TSAL, R.K., tekhn.red.

[Materials for electricians in shipbuilding] Materialovedenie
dlia elektrikov-sudostroitelei. Leningrad, Gos.soiuznoe izd-vo
sudostroit.promyshl., 1960. 212 p. (MIRA 13:5)
(Shipbuilding--Supplies) (Electricity on ships)

BEREZIN, B.L., insh.

Evaluating the effectiveness of repairing and modernizing construction equipment. Transp. stroi. 15 no.7:36,49 J1 '65. (MIRA 18:7)

BEREZIN, B.I., kand. tekhn. nauk

Typewriting school. Nauka i zhizn' 29 no.6:104-107 Je '62.
(MIRA 15:10)

(Typewriting--Study and teaching)

ZONIS, Semen Aleksandrovich; MAZUROV, Sergey Mikhaylovich; ~~BEREZIN,~~
B.I., red.; ZAKHARIKOVA, Ye.I., red.izd-va; GARINA, T.D.,
tekh. red.

[Laboratory and lecture experiments and demonstration materials
in organic chemistry] Laboratorno-lektsionnye opyty i demon-
stratsionnye materialy po organicheskoi khimii. 1zd.2., ispr.
i dop. Moskva, Gos. izd-vo "Vysshaya shkola," 1961. 720 p.
(MIRA 15:3)

(Chemistry, Organic--Laboratory manuals)

BEREZIN, Boris Ivanovich; ROMM, R.S., red.; SHPAK, Ye.G., tekhn. red.

[Printing ink] Pечатnye kraski. Moskva, Gos. nauchno-tekhn.
izd-vo khim. lit-ry, 1961. 215 p. (MIRA 14:11)
(Printing ink)

BEREZIN, B.I., *otv. red.*; KOZAROVITSKIY, L.A., *red.*; MEDVEDEV,
Ye.M., *red.*; POPOVA, A.L., *red.*; PORRYADUKHIN, P.A., *red.*
SEMENOV, S.S., *red.*; SOPOVA, O.I., *red.*

[Transactions of the Conference on the Scientific Basis
of the Processes of Printing and Methods for Their
Improvement] Trudy Konferentsii po nauchnym osnovam pro-
tssessov pechataniia i putiam ikh sovershenstvovaniia, Mo-
skva, Nauchno-tekhn. ob-vo poligr. i izdatel'stv. No.1.
1961. 44 p. (MIRA 18:5)

1. Konferentsiya po nauchnym osnovam protsessov pechata-
niya i putyam ikh sovershenstvovaniya, Moscow, 1961.

BEREZIN, Boris Ivanovich; VINOGRADOV, V.L., red.; ROZEN, E.A., tekhn.red.

[Printing industry materials; a textbook] Poligraficheskie materialy;
uchebnik. Moskva, Izd-vo "Sovetskaya Rossiya," 1960. 560 p.
(MIRA 13:7)

(Paper products)

(Printing machinery and supplies)

CHEBOTAREVSKIY, Vladimir Vladimirovich; BEREZIN, B.I., otv.red.;
FETISOVA, R.M., red.izd-va; GOLUB', S.P., tekhn.red.

[Lacquers and paints in the national economy] Laki i kraski
v narodnom khoziaistve. Moskva, Izd-vo Akad.nauk SSSR, 1960.
99 p. (MIRA 13:4)

(Lacquer and lacquering)

KISELEVA, Nadezhda Alekseyevna; BEREZIN, B.I., kand.tekhn.nauk; BORISHCHEVA,
M.M., red.; CHICHERIN, A.N., tekhn.red.

[Chemical analysis of printing industry materials] Khimicheskii
analiz poligraficheskikh materialov. Moskva, Gos.izd-vo
"Iskusstvo." Pt.1. [Testing printing industry materials] Ispytaniia
poligraficheskikh materialov. 1958. 183 p. (MIRA 12:4)
(Printing machinery and supplies)

BEREZIN, B.I.

BEREZIN, B.I., kandidat tekhnicheskikh nauk.

Once more about State standards on printing paper. Bum.prom.

32 no.4:27 Ap '57.

(MIRA 10:7)

(Paper--Standards)

HERZIN, B.I., kandidat tekhnicheskikh nauk.

Kinds of coated papers for the printing industry. Bum.prom.30
no.10:20-21 0'55. (MLRA 9:1)

(Paper coatings)

BREZIN, Boris Ivanovich; ZAGARINSKAYA, Lyudmila Aleksandrovna; ZARKHINA,
M.Ye.; ALEKSANTROV, V.I., tekhn.red.

[Printing materials] Poligraficheskie materialy. Moskva, Gos.
izd-vo "Iskusstvo," 1955. 618 p. (MIRA 12:3)
(Printing machinery and supplies)
(Bookbinding--Equipment and supplies)

BERKIN, B.I., kandidat tekhnicheskikh nauk.

Printing properties of paper. *Bum.prom.* 28 no.8:12-15 Ag '53.

(MLRA 6:7)
(Paper)

BEREZIN, B.I., kandidat *tehnicheskikh nauk* (Moscow).

Staining of litho-offset forms and problems concerning the theory of printing element formation. *Poligr. proiz.* 4:15-16 Ap '53. (MLRA 6:6)
(Lithography--Metal plate processes)

BEREZIN, B I

Poligraficheskiy retsepturnyy spravochnik
(Polygraphic Prescription Book)
Moskva, Gos. Izd-vo "Iskusstvo", 1953. 311 p. tables.
Bibliographic footnotes.

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31

The attaching [or cementing on] of synthetic cliches. B. I. Bergin. *Patigaf. Prizvestio* 1948, No. 2, 19-20; *Chem. Zvest.* 1949, 204-5.—The following adhesives are recommended for cementing on typographic plates of polyvinyl chloride plasticized with diethyl phthalate: (1) leather or bone glue with 10% glycerol, (2) a 10-15% polyvinyl chloride soln. of the type PB-III in dichloroethane (which is better), (3) carbinol sirup with 0.1-0.25% Edgeright stabilizer and 2-3% benzoyl peroxide or 1-2% HNO₃ as catalyst (which is still better), (4) a 10-15% soln. of rubber in benzene, and (5) friction tape.

M. G. Moore

1ST AND 2ND ORDERS										3RD AND 4TH ORDERS									
PROCESSES AND PROPERTIES INDEX										25									
<p>B</p> <p>A New Method for Determination of the Absorptive Properties of Paper. (In Russian.) B. V. Deryagin and B. I. Herzig. <i>Polygraficheskoi Proizvodstvo</i> (Printing Industry), Oct. 1948, p. 22-26.</p> <p>A new method and apparatus are described and diagrammed. Typical results are graphed and discussed.</p>																			
COMMON ELEMENTS										2									
MATERIALS INDEX										3									
ASB-318 METALLURGICAL LITERATURE CLASSIFICATION										4-2									
1ST AND 2ND ORDERS										AUTHOR INDEX									
3RD AND 4TH ORDERS										1ST AND 2ND LETTERS									
3RD AND 4TH LETTERS										3RD AND 4TH LETTERS									

BEREZIN, B

I

Poligraficheskiye Materialy. (Polygraphic Materials)...Uchebnik...Moskva,
Gizlegprom, 1948.

304 P. Illus., Diags.
Bibliographies at end of chapters.

Gives information on designation, quality and working principles of Polygraphic
materials, applicable for courses in studying material used for polygraphic production.

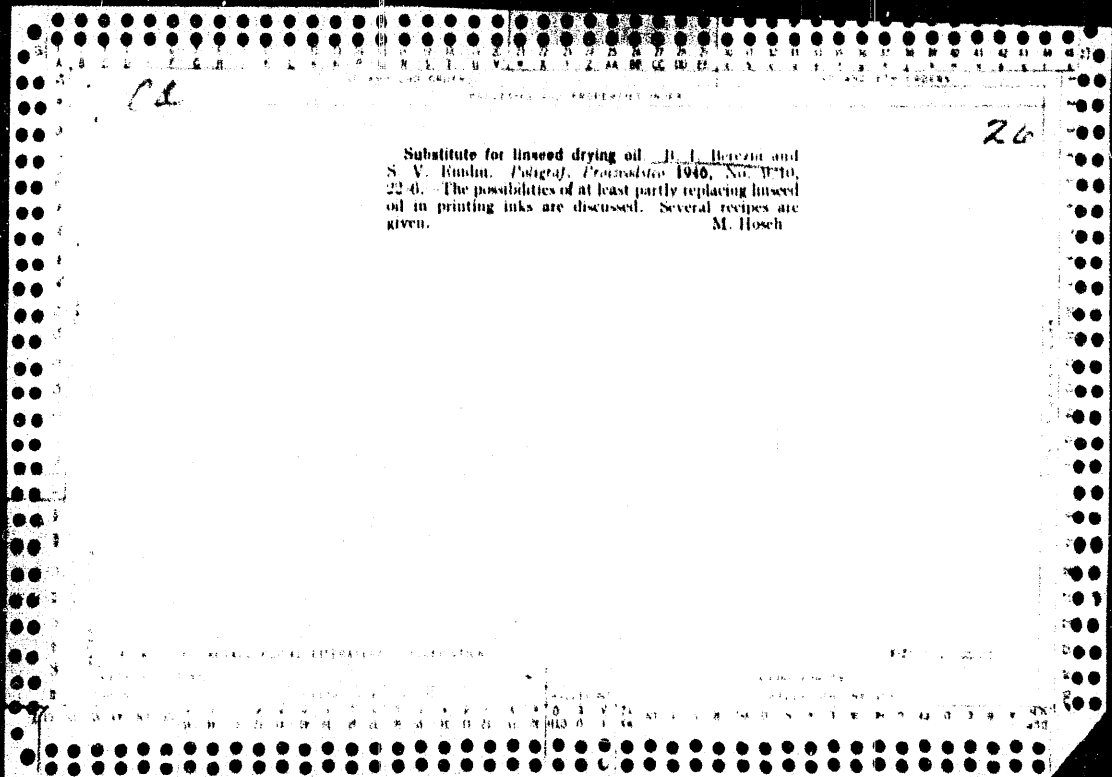
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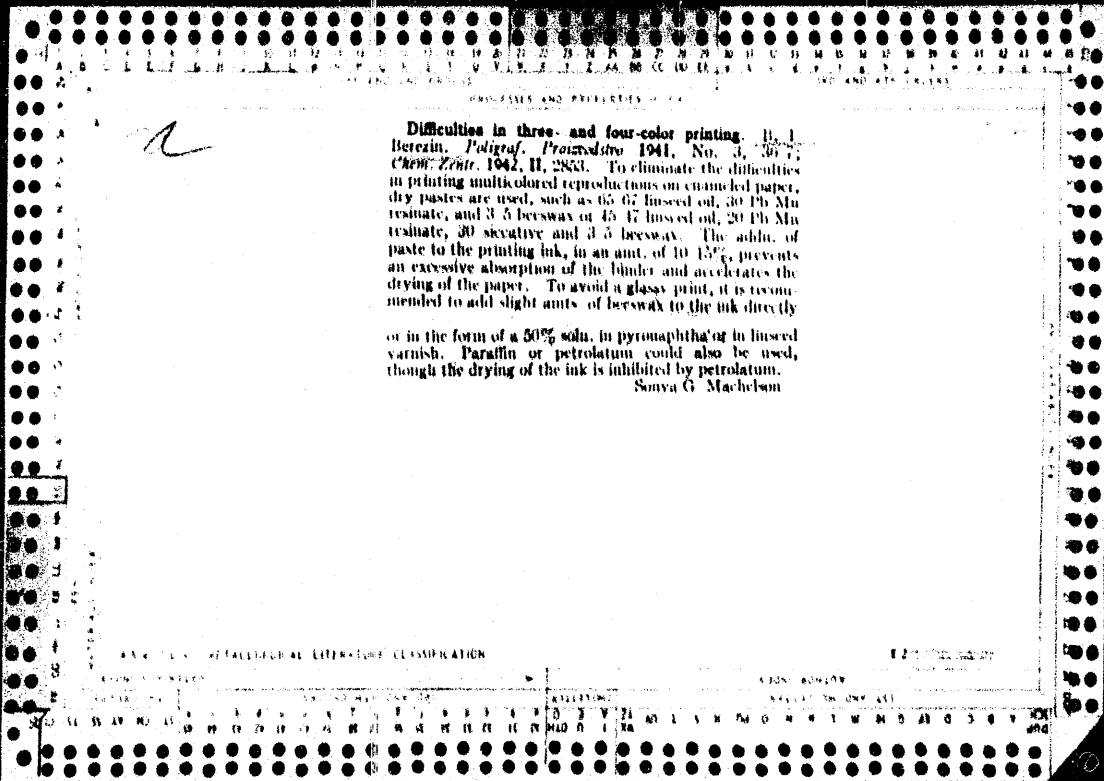
Testing the absorbency of paper by means of photoelectric apparatus. V. I. Mudrik and B. I. Beregin. *Poligraf. Proizvodstvo* 1946, No. 11/12, 24-6. -- The photoelec. method of TAPPI for testing paper absorbency is described. M. Horsch

23

ASME 33.4 METALLURGICAL LITERATURE CLASSIFICATION

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1ST AND 2ND ORDERS PROCESSES AND PROPERTIES INDEX 3RD AND 4TH ORDERS

23

Production of metallized paper. B. I. Berezin. *Dokl. Akad. Nauk SSSR*, 1940, No. 4, 28-36(1940). A discussion of the methods of production and uses of metal-coated paper, based on foreign practice and patents. D. I. Belyaf. *Ibid.*, No. 5, 25-8(1940). -- Foreign methods of production and uses are discussed. Chas. Blanc

ASA SIA METALLURGICAL LITERATURE CLASSIFICATION

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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PROCESSSES AND PROPERTIES INDEX																			
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<p>Increasing the resistance of pigments to water in flat printing. D. I. Berezin. <i>Poligraf. Proizvodstvo</i> 1939, No. 11, 42; <i>Khim. Referat. Zhur.</i> 1940, No. 6, 119. --To increase the water-resistance of dyes used for lithographic offset printing it is proposed to moisten the printing mold with a soln. of a suitable pptg. agent instead of with water. The method prevents the dyes from dissolving in water in the printing process and has no effect on the quality of the mold.</p> <p>W. R. Henn</p>																			
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COMMON ELEMENTS			
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The properties of drying oils used in printing. N. I. Bergain and T. N. Malova. <i>Poligraf. Proizvodstvo</i> 1939, No. 10, 37-8; <i>Khim. Refrat. Zhur.</i> 1940, No. 6, 110. A comparative evaluation is given of drying oils used in printing (linseed, petroleum and rosin). W. R. Henn			
ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION			
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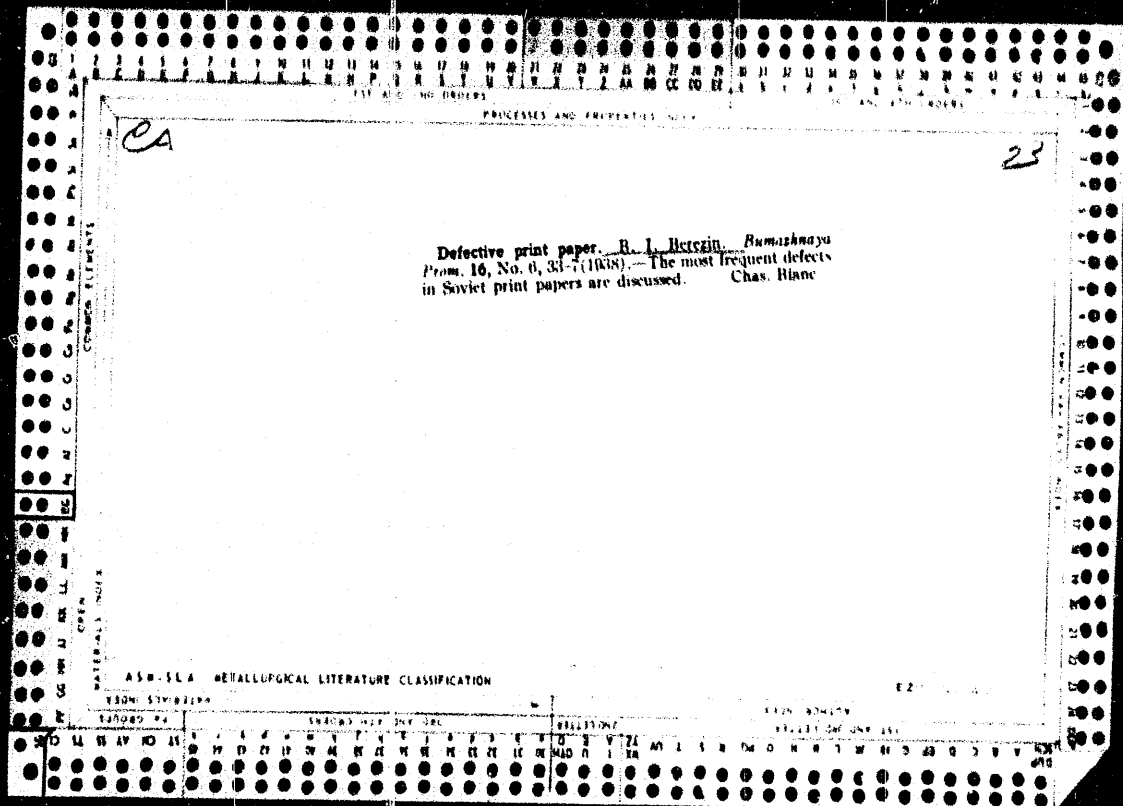
PROCESSED AND FORWARDED TO:

Standards for print paper." D. I. Herstein. *Russkaya Prom.* 10, No. 4, 37-41 (1938). A review of literature on the standard chem., phys. and mech. properties of print paper and methods of testing. Fifteen references. Chas. Blanc

23

ALU-51A METALLURGICAL LITERATURE CLASSIFICATION

ALU-51A	METALLURGICAL LITERATURE CLASSIFICATION	E2
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1ST AND 2ND ORDERS										PROCESSES AND PROPERTIES INDEX										3RD AND 4TH ORDERS																															
Measuring the absorptive power of paper toward print ink. H. J. Rezzin. <i>Papierfabrik</i> 15, No. 2, 2(1937); <i>Chimie & Industrie</i> 39, 151. The method consists essentially in printing a weighed strip of the paper with a standard ink, removing the excess of ink by repeated contact with clean paper and weighing again, the increase in wt. corresponding to the ink absorbed. A two-roll press is used in carrying out the detn. A. Papineau Contin.																																																			
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Acidol as a solvent for grease paints. B. I. Berezin. <i>Nefl</i> 8, No. 1, 80(1967).--Acidol, a mixt. of fused naphthene acids obtained from petroleum, can be used instead of oleic acid for dissolving indoline. Acidol contg. over 3% Na salts of naphthene acids or 0.5% of sulfonic acids cannot be used as an indoline solvent. A. A. Podgoray																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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BEREZIN, B.I., kand. tekhn.nauk

Typewriting school. Nauka i zhizn' 29 no.2:74-78 F '62.
(MIRA 15:3)

(Typewriting)

BEREZIN, B.D.; SOSNIKOVA, N.I.

Kinetics of the formation of metal pheophytinates, analogs
of chlorophyll. Zhur. fiz. khim. 39 no.6:1348-1355 Je '65.
(MIRA 18:11)

1. Ivanovskiy khimiko-tekhnologicheskii institut. Submitted
Dec. 14, 1963.

BEREZIN, B.P., inzh.

Centralization of the repair of machinery. Vest.mashinostr.
45 no.10:70-77 0 '65.

(MIRA 18:11)

BEREZIN, B.D.

Calculation from kinetic data of relative equilibrium constants
for reactions of phthalocyanine and porphyrin complex formation.
Zhur. fiz. khim. 39 no.5:1082-1086 My '65. (MIRA 18:8)

1. Ivanovskiy khimiko-tehnologicheskii institut, Ivanovo.

BEREZIN, B.D.

Structural peculiarities of a phthalocyanine molecule.
Zhur. fiz. khim. 39 no. 2:321-327 F '65. (MIRA 18:4)

1. Ivanovskiy khimiko-tekhnologicheskii institut, Ivanovo.

BEREZIN, B.P.; NOSNIKOVA, N.I.

Kinetics of the formation of metal pheophytinates, analogs of
chlorophyll. Zhur. fiz. khim. 38 no.5:1216-1222 My '64.
(MIRA 18:12)
I. Ivanovskiy khimiko-tekhnologicheskij institut. Submitted
June 18, 1963.

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BEREZIN, B.D.

Interrelation between the stability and kinetic characteristics of
phthalocyanine complexes. Zhur. fiz. khim. 38 no.2957-2961 D '64.
(MIRA 18:2)

1. Ivanovskiy khimiko-tehnologicheskij institut.

ACCESSION NR: AP4034575

nature of the central atom. The dissociation of metalphthalocyanines (MPc) in aqueous proton-containing solutions is irreversible: $MPcH^+ + 2H_2O \rightarrow M_{aq}^{2+} + H_2PcH^+$. The entropy and energy of activation of this dissociation reaction were calculated. It was suggested that in the process of the trimolecular reaction the activated complex $(MPcH^+ \cdot 2H_2O)^{**}$ forms from the initial $MPcH^+$ and H_3O^+ because of their strong mutual polarization. The negative values of the entropy of activation are explained by the high charge and strong polarization of the activated complex which makes it more strongly solvated than the initial particles. The special role of the H_3O^+ as a source of H_2O molecules required for the formation of the activated complex and completion of the dissociation is pointed out. "N. I. Sosnikova took part in the experimental work."... "I thank prof. K. B. Yatsimirsk for discussion of the given work." Orig. art. has: 3 tables, 6 figures and 7 equations.

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskii institut (Ivanow Chemical Technological Institute)

SUBMITTED: 13Feb63

ENCL: 00

SUB CODE: GC

NO REF SOV: 013

OTHER: 005

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ACCESSION NR: AP4034575

8/0076/64/038/004/0850/0857

AUTHOR: Berezin, B. D. (Ivanovo)

TITLE: The mechanism of dissociation of metalphthalocyanines

SOURCE: Zhurnal fizicheskoy khimii, v. 38, no. 4, 1964, 850-857

TOPIC TAGS: metal phthalocyanine, dissociation, mechanism, dissociation rate, activation energy, activation entropy, metalphthalocyanine hydronium ion complex, trimolecular reaction

ABSTRACT: The dissociation rate of stable Co, Ni, Al, Ga, Os(IV), Rh(III) phthalocyanines in sulfuric acid solutions in the 100-160C range was investigated. The general equation

$$-\frac{dc_{MPcH^+}}{dt} = k_0 c_{MPcH^+} c_{H_3O^+}^2$$

(where c_{MPcH^+} is the concentration of the phthalocyanine proton in solution) was found to obtain for the dissociation of the metalphthalocyanines regardless of the

Card 1/2

BEREZIN, B.D.

Synthesis and properties of gallium phthalocyanines. Izv. vys. ucheb. zav.; khim. i khim. tekh. 7 no. 6: 982-988 '64.

(MIRA 18:5)

1. Ivanovskiy khimiko-tekhnologicheskiy institut, kafedra analiticheskoy khimii.

53

ACCESSION NR: AP4041680

ENCLOSURE: 03

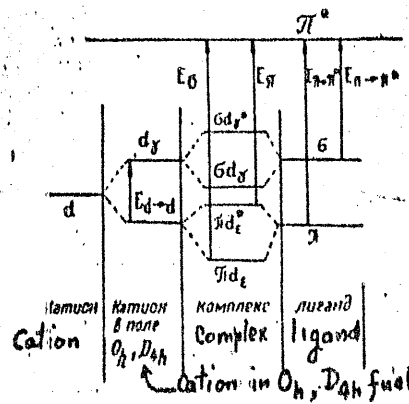


Fig. 3

Arrangement of energy equilibria of complexes with cyclic ligands

Card 6/6

ACCESSION NR: AP4041680

ENCLOSURE: 02

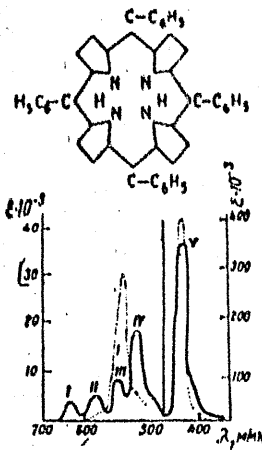


fig 2

Tetraphenylporphorin and its absorption spectra. --- metal-free; . . . copper complex with benzene (I, II, III, IV, V--absorption band numbers)

Card 5/6

54"

ACCESSION NR: AP4041680

ENCLOSURE #01

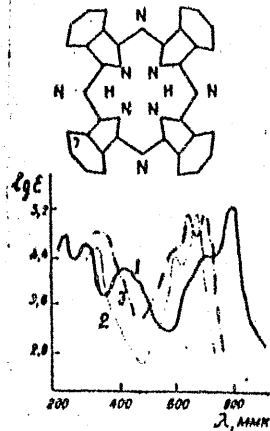


fig. 1

Skeletal formula of phthalocyanine and its absorption spectra. 1--copper phthalocyanine in 18 M H₂SO₄; 2--copper phthalocyanine in -chlornaphthalene; 3--metal-free phthalocyanine in chlornaphthalene

Card 4/8

ACCESSION NR: AP4041680

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskii institut Laboratoriya termodinamiki khimicheskikh reaktsiy (Ivanovo Chemical Technological Institute Laboratory of the Thermodynamics of Chemical Reactions)

SUBMITTED: 18May63

ENCL: 03

SUB CODE: *NP, GC*

NR REF SOV: 013

OTHER: 013

51

ACCESSION NR: AP4041680

remaining bands are caused by $\pi \rightarrow \pi^*$ transitions. In a series of divalent cations the short wave shift increases in proportion to the stability of the complex; the shift with tri- and tetravalent cations is still greater. However the magnitude of the hypsochromic shift does not correspond to the stability of the complex. Thus it was shown the shift of the primary absorption band of the electron spectra of the π -ligands depends not only on the strength of the σ -band but appears to be also a function of the nature and strength of the π -band, of the magnitude of the effective charge of the central ion in the complex, and of the geometric factor of the distortion of the ligand of the π -system upon coordination. All of these electronic and structural factors have a different effect on the strength of the complex and on the electronic equilibrium of the π -ligand. It is therefore indicated that the spectral criterion used in foreign works (i.e., the greater strength of the complexes with organic π -ligands results in the greater hypsochromic shift) has very limited value. The energy equilibria of the complex, cation and cyclic π -ligand are shown schematically in Fig. 3. Orig. art. has: 2 tables and 5 figures.

Cord 2/6

ACCESSION NR: AP4041680

S/0153/64/007/002/0202/0208

TITLE: Electron absorption spectra and stability of monotypic complexes

AUTHOR: Berezin, B. D.

SOURCE: IVUZ. Khimiya i khimicheskaya tekhnologiya, v. 7, no. 2, 1964, 202-208

TOPIC TAGS: electron absorption spectra, spectral band shift, cyclic pi-ligand, phthalocyanine, porphorin, coordination complex, tetraphenyl-porphorin, sigma bond strength, pi bond strength, hypsochromic shift

ABSTRACT: The relationship between the stability of complexes and the position of their absorption bands was investigated by examining in detail the shift in the absorption band in cyclic π -ligands with phthalocyanine and porphorin upon coordination with different metal ions. The shift in the long wave bands of the spectrum of phthalocyanine (Fig. 1) on complexing with Cu in α -chloronaphthalene is attributed to the $\pi \rightarrow \pi^*$ transition. In $\alpha, \beta, \gamma, \delta$ -tetraphenylporphin (Fig. 2) bands II and IV are caused by $\pi \rightarrow \pi^*$ transitions while the 3

Card 1/6

BEREZIN, B.D.

Physicochemical properties of phthalocyanine pigments. Part 3:
Breakdown of pigment molecules in acid solutions. Chromaticity
of phthalocyanines. Izv.vys.ucheb.zav.;khim. i khim. tekhn.
7 no. 1:111-117 '64. (MIRA 17:5)

1. Ivanovskiy khimiko-tekhnologicheskii institut, kafedra
analiticheskoy khimii.

BEREZIN, B.D.

Dissociation kinetics of stable metal phthalocyanins in sulfuric acid solutions. Zhur. fiz. khim. 37 no.11:2071-2074 #63.
(MIRA 17:2)

1. Ivanovskiy khimiko-tekhnologicheskii institut.

ACCESSION NR: AP4025263

1956) a theoretical analysis of the process of reprecipitation of phthalocyanine pigments (primarily in the example of CuPc) was conducted. Optimum conditions for their solution and sulfuric acid consumption required for the full solution of pigments are found. Values for sulfuric acid consumption (kilogram) needed for the total solution of 100 kg. pigment of blue phthalocyanine (calculated for pure CuPc) are given for 10 and 50 C. It follows from the data, that in the process of reprecipitation of pigment from H₂SO₄ solutions with less than 94% concentration only a small part of the pigment is exposed to the solution and consequently is converted into d-form; a basic part of the pigment to microcrystal degree, is in B-form. Orig. art. has: 4 tables.

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskii institut (Ivanov Chemical Engineering Institute); Kafedra analiticheskoy khimii (Department of Analytical Chemistry)

SUBMITTED: 02Oct62

DATE ACQ: 10Apr64

ENCL: 00

SUB CODE: CH

No. REF. SOV: 010

OTHER: 002

Card 2/2

ACCESSION NR: AP4025263

S/0153/63/006/006/1016/1021

AUTHOR: Berezin, B.D.

TITLE: Physico-chemical properties of phthalocyanine pigments
2. Processes of dissolving phthalocyanines in sulfuric acid and its derivatives

SOURCE: IVUZ. Khimiya i khimicheskaya tekhnologiya, v. 6, no. 6, 1963, 1016-1021

TOPIC TAGS: Phthalocyanine pigment, phthalocyanine, sulfuric acid, phthalocyanine dissolution

ABSTRACT: Under industrial and laboratory conditions, phthalocyanine pigments containing metal are mostly obtained using dry methods. For this purpose, the metals and their chlorides or oxides are coalesced with the phthalocyanine or with a mixture containing phthalic anhydride, urea and a catalyst. The reaction product is an extremely complex mixture. The chemical activity and thermodynamics of the reprecipitation processes of industrial fusions of phthalocyanine from solutions of sulfur, chlorosulfonic acid and fuming sulfuric acid are examined. Based on a previously given thermodynamic ration (F. Baumann et al. Angew. Chem. 68, 133,

Card 1/2

1 12669-63
ACCESSION NR: AP3002573

REF(C)/EXT(M)/EBS AFPTC/ASD/ESD-3 RM/JD

8/0020/63/150/005/1039/1042

AUTHOR: Berezin, B. D.

TITLE: Synthesis and properties of rhodium phthalocyanin

SOURCE: AN SSSR. Doklady, v. 150, no. 5, 1963, 1039-1042

TOPIC TAGS: synthesis, property, rhodium phthalocyanin, acid-stable phthalocyanin, rhodium phthalocyanin, (HSO sub 4) RhFe, dissociation, equilibrium constant, Rh sup plus 3, Os sup plus 4, Pt sub plus 2, Pd sub plus 2

ABSTRACT: Supplementing earlier work of B. Berezin and N. Sosnikova (DAN, 146, 1962, 604) on acid-stable phthalocyanines, anhydrous trivalent rhodium chloride was reacted with a five-fold excess of phthalonitrile, with cooling for 4 hrs, to form rhodium phthalocyanine, purified from acetone and from 96% H sub 2 SO sub 4, the complex (HSO sub 4) Rh was formed. Solubility was determined and dissociation and equilibrium constants were calculated for Rh sup plus 3, Os sup plus 4, Pt sup plus 2, Pd sup plus 2, Cu sup plus 2, and Al sup plus 3 phthalocyanines. The effective ion charges and character of the chemical bonds in the Rh and Os complexes are discussed extensively. Absorption spectra of Rh, Os, and Pd phthalocyanin are compared. The article was presented by Academician A. K. Association: Ivanov Inst. of Chemical Technology
Card 1/2

59
58

17907-63
ACCESSION NR: AP3003764

limited by the solubility of proton accepting phthalocyanine salts. This solubility is not possible to determine. However, it must be very large since it has a large dielectric constant and the acidic salts are highly soluble in this media. These systems must be close to the fused systems since their equilibrium apparently can be reached only at high temperatures. Orig. art. has 3 graphs and 15 equations.

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskii institut (Ivanovo Chemical Engineering Institute.)

SUBMITTED: 04Feb62

SUB CODE: CH, EL

DATE ACQ: 07Aug63

NO REF SOV: 007

ENCL: 00

OTHER: 012

Card 2/2

17907-53 RFE(a) RFE/EMP(j)/SWI(z)/EBS Pa-ii/Pr-ii/Pe-ii/Pi-ii DE/RA/

AGENCIJA NR: AP3003764

8/0080/83/036/006/1181/1186

AUTHOR: Beresin, B. D.

TITLE: Solubility of phthalocyanines in chlorosulfonic acid and oleum

SOURCE: Zhurnal prikladnoy khimii, v. 36, no. 6, 1963, 1181-1186

TOPIC TAGS: phthalocyanine, oleum, chlorosulfonic acid

ABSTRACT: The application of thermodynamic data obtained from the study of phthalocyanine behavior in sulfuric acid and also the functional properties of the acidity in the concentrated solutions of strong acids, permit the calculations of the solubility equilibrium of phthalocyanines in chlorosulfonic acid and oleum. It also evaluates the magnitude of solubility of phthalocyanines. From the experimental data it can be concluded that the solubility equilibrium of phthalocyanine in HOSO_2Cl is extremely large. In a 30% solution of chlorosulfonic acid its solubility is practically unlimited. At low concentrations of HOSO_2Cl its solubility is limited. Thus, the concentration of HOSO_2Cl approximately determines the solubility of phthalocyanine. This is especially true in the case of oleum since the acidity of the media containing $\text{H}_2\text{S}_2\text{O}_7$ is much higher than the media containing HOSO_2Cl . It is possible that the solubility in HOSO_2Cl and oleum will be

Card 1/2

BEREZIN, B.D.

Physicochemical properties of phthalocyanine pigments. Part 1:
General characteristics of phthalocyanins. Stability of solid
pigments during acid treatment. Izv.vys.ucheb.zav.;khim.i khim.tekh.
6 no.5:841-846 '63. (MIRA 16:12)

1. Ivanovskiy khimiko-tehnologicheskoy institut, kafedra analiticheskoy
khimii.

BEREZIN, B.D.; SOSNIKOVA, N.I.

Synthesis and properties of osmium phthalocyanine. Dokl. AN SSSR
146 no.3:604-607 S '62. (MIRA 15:10)

1. Ivanovskiy khimiko-tekhnologicheskii institut. Predstavleno
akademikom A.N.Tereninym.
(Osmium compounds) (Phthalocyanine)

BRREZIN, B.D.

Thermodynamic characteristics of phthalocyanines in sulfuric acid solutions. Zhur.neorg.khim. 7 no.11:2507-2513
N '62. (MIRA 15:12)

1. Ivanovskiy khimiko-tekhnologicheskii institut.
(Phthalocyanine) (Sulfuric acid) (Solubility)

BEREZIN, B.D.

Some properties of platinum and palladium
phthalocyanines. Zhur.neorg.khim. 7 no.11:2500-2506
N-62. (MIRA 15:12)
(Platinum compounds) (Palladium compounds)
(Phthalocyanine)

Study of metal ...

S/076/62/036/003/003/011
B101/B108

by W. Caughey, A. Corwin (see below) about the mechanism of decomposition of metallic ethioporphyryne complexes are called erroneous. There are 7 figures, 3 tables, and 9 references: 4 Soviet and 5 non-Soviet. The four most recent references to English-language publications read as follows: W. Caughey, A. Corwin, J. Amer. Chem. Soc., 77, 1509, 1955; P. Barrett, D. Frye, R. Linstead, J. Chem. Soc., 1157, 1938; J. Anderson, E. Bradbrook, A. Cook, R. Linstead, J. Chem. Soc., 1151, 1938; P. Barrett, R. Linstead, F. Rundall, G. Tuey, J. Chem. Soc., 1079, 1940.

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskii institut (Ivanovo Institute of Chemical Technology)

SUBMITTED: May 25, 1960

Card 3/3

Study of metal ...

S/076/62/036/003/003/011
B101/B108

hour) at room temperature even in diluted H_2SO_4 . The unstable MPc's had constants of hydrolyzation rate different from that of H_2Pc (0.137 ± 0.008 per hour) by one order of magnitude. Unlike the unstable MPc's whose spectra show only the absorption bands of $HePcH^+$, the stable MPc's displayed absorption bands of their own. Hydrolysis proceeds as $MPc_{sd} + H_2SO_4 \rightleftharpoons MPcH^+$ + $H_2SO_4^-$ (2); $MPcH^+ + 2H_3O^+ \xrightarrow{v_2} M_{aq}^{2+} + H_2PcH^+$ (3); $H_2PcH^+ + 3H_2O \xrightarrow{v_3}$ decomposition products (4). For stable MPc's, the reaction (3) is limiting, which proceeds according to $-dc_{MPc}/dt = k_{MPc} c_{MPc}^2 c_{H_3O^+}$, while for the unstable MPc's, the reaction (3) proceeds rapidly and the reaction (4) slowly. For that group the kinetic equation as found for H_2Pc is $-dc_{MPc}/dt = k_{H_2Pc} c_{MPc}^4 c_{H_3O^+}$. For the hydrolysis of H_2Pc in 17.7 M H_2SO_4 the activation energy was found to be 19,500 cal, for the reaction $Cl_2SnPcH^+ + 2H^+ \rightarrow H_2PcH^+ + Sn^{IV} + 2Cl^-$ it was found to be 21,700 cal. The assumptions made

S/076/62/036/003/003/011
B101/B108

573700
AUTHOR: Berezin, B. D.

TITLE: Study of metal phthalocyanines in solution. VI. Effect of the nature of the central ion on the strength of the phthalocyanine macro-ring in sulfuric acid solutions

PERIODICAL: Zhurnal Fizicheskoy khimii, v. 36, no. 3, 1962, 494 - 501

TEXT: The stability of the compounds MPC of phthalocyanine (H_2Pc) with Cu^{2+} , Ni^{2+} , Co^{2+} , Zn^{2+} , Sn^{2+} , Sn^{4+} , Al^{3+} , VO^{2+} , Cd^{2+} , Pb^{2+} , Mg^{2+} , Ag^+ , Fe^{3+} as well as of the chlorinated compounds $Cl_{15}PcCu$ in 12 - 17.7 mole/liter H_2SO_4 was investigated at 25 - 65°C. The compounds can be divided into two groups: (1) stable compounds of Cu^{2+} , Co^{2+} , Ni^{2+} , Zn^{2+} , Al^{3+} , VO^{2+} , which displayed no noticeable dissociation at room temperature, (2) unstable compounds of Mg^{2+} , Cd^{2+} , Ag^+ , Pb^{2+} , Fe^{3+} , Sn^{2+} , Sn^{4+} . The stable MPC's and $Cl_{15}PcCu$ had very small constants of hydrolyzation rate ($k \sim 10^{-4}$ per

Card 1/3

BEREZIN, B.D.

Remarks on the article by I.L.Kukhtevich "On chemical stability of α - and β -pheophytins of copper and zinc. Ukr.khim.zhur. 28 no.4:532-534 '62. (MIRA 15:8)

1. Ivanovskiy khimiko-tekhnologicheskij institut.
(Pheophytins)

30702

Methods of investigating...

S/020/61/141/002/013/027
B103/B110

Ref. 7: R. Williams, Chem. Revs, 56, 299 (1956); Ref. 10: W. Caughey,
A. Corwin, J. Am. Chem. Soc., 77, 1509 (1955); Ref. 16: N. Deno, R. Taft,
J. Am. Chem. Soc. 76, 244 (1954).

ASSOCIATION: Ivanovskiy khimiko-tehnologicheskii institut (Ivanovo
Institute of Chemical Technology)

PRESENTED: June 23, 1961, by A. N. Terenin, Academician

SUBMITTED: June 22, 1961

Table 1. pK of the equilibrium constants of reaction (3) of stable
phthalocyanins at 25°C.

Legend: (1) Phthalocyanin.

Table 2. Temperature dependence of pK of phthalocyanins in H₂SO₄.

Legend: (1) Temperature, °C; (2) pK of phthalocyanins of metals.

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B103/B110

Methods of investigating...

the same manner as free Pc. The hydrolysis of H_2PcH^+ is complicated. The hydrolysis mechanism of stable MPC was studied with the most unstable MPC: $(HSO_4)_2SnPc$. The hydrolysis also follows the equation $MA_n \rightleftharpoons M^{n+} + nA^-$ (1). The limiting stage in unstable Pc, however, is the hydrolysis of the H_2PcH^+ macroring, whereas in stable MPC it is the metal separation (2a).

Thus, four coordinate bonds between metal and nitrogen are ruptured. The hydrolysis of stable Pc is only noticeable, at 100 - 120°C. As to the readiness of separation of the central ion in Pc, the metals form the order $V^{4+} > Zn^{2+} > Cu^{2+} > Co^{2+} > Ni^{2+} > Pd^{2+} > Pt^{2+}$. At the same time, the basic properties of the four N atoms of the rings participating in (2) and (2a) are increasingly neutralized. Pt^{2+} has the highest stability, but also $(HSO_4)AlPc$ is very stable. The above order reflects the stability order in porphyrin complexes: $Ba^{2+} > Mg^{2+} > Mn^{2+} > Fe^{2+} > Zn^{2+} > Cu^{2+} > Co^{2+} > Ni^{2+} > Pd^{2+}$. There are 6 tables and 18 references: 12 Soviet and 6 non-Soviet. The three references to English-language publications read as follows:

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Methods of investigating...

Since the constants remain unchanged at all temperatures, concentrated H_2SO_4 is an ideal solvent. Thus, the ratio of activity coefficients of the reactants in (3) also remains constant, and the reaction product, $(MPcH)HSO_4$, is completely dissociated. $MPcH^+$ predominates in sulfuric acid solutions. The equilibrium constants pK of reaction (3) allow conclusions as to the formation and durability of σ - and π -bonds, the stability of MPc , the existence of an excessive charge on the central ion, and the induction effect of the substituents in the benzene ring. The effect observed is an endothermic one which decreases with increasing solvation ability of Pc , either because of the ability of additional coordination of the central ion ($ZnPc$, $ZnPcCl$), or due to a charge of the central ion (^+AlPcCl), or the polarization of bonds in the chlorination of benzene rings ($CuPcCl_{15}$). Pc disintegrates in sulfuric acid solutions and is completely hydrolyzed on the macroring.

$[H_2(C_8H_4N_2)_4H^+] + 8H_2O + 3H^+ \rightarrow 4C_8H_5O_2N + 4NH_4^+ + H_2$. The coloring of $MPcH^+$ and H_2PcH^+ disappears. All unstable Pc were found to hydrolyze in

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B*03/B110

Methods of investigating...

of stable Pc formed by Cu^{2+} , Zn^{2+} , Co^{2+} , Ni^{2+} , Fe^{2+} , Pd^{2+} , V^{4+} , AlCl_2^{2+} , and partly SnCl_2^{2+} , according to Eqs. (2) and (2a) is hardly noticeable.

In aqueous, acid media, stable Pc dissociate irreversibly according to (2) and (2a). Despite a marked ionic dissociation in acid media, Pc cannot be characterized by the equilibrium constant of (2) or (2a). In those cases where it is difficult or impossible to determine the instability constant, or where the binding energy between metal and addenda cannot be measured, it is possible to apply, among others, the method of determining the rate of metal separation under the action of acids (Ref. 10, see below). This method was tested on Pc complexes. The forms of Pc existence in H_2SO_4 at various temperatures, and the properties of H_2SO_4 as solvent were studied in preliminary experiments. In an earlier study (Khim. i khim. tekhnol. 2, 165 (1959); 4, 45, 379 (1961)) the author proved that Pc in concentrated H_2SO_4 at normal temperatures behaved like monoacid bases:

$\text{MPc}_s + \text{H}_2\text{SO}_4 \rightleftharpoons \text{MPcH}^+ + \text{H}_2\text{SO}_4^-$ (3). Table 1 gives equilibrium constants of Eq. (3) at 25°C. Those of industrially important Pc are given in Table 2.

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P103/P110

53700

AUTHOR: Berezin, N. D.

TITLE: Methods of investigating the stability of phthalocyanine complex compounds

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 24, no. 2, 1961, 353-356

TEXT: The dissociation of metal phthalocyanines which is only noteworthy in proton acid media was studied in this paper: $MPc_g + 2H^+ = M^{2+} + H_2Pc_g$ (2); $MPcH^+ + 2H^+ = H_2PcH^+ + M^{2+}$ (2a), where Pc is the bivalent anion of tetrabenzo tetrazaporphin (phthalocyanine), and M^{2+} is a metal ion. Process (2) takes place in solid phase, and (2a) in H_2SO_4 with a concentration of more than 8 moles/liter. Processes (2) and (2a) were found to be fast and irreversible with unstable phthalocyanines, i. e., with those formed by cations of alkalis, alkaline earths, Hg^{2+} , Cd^{2+} , Pb^{2+} , Mg^{2+} , Be^{2+} , Ag^+ , Fe^{2+} , and those containing Sb^{3+} , Mn^{2+} , and Sn^{2+} . The conversion

Card 1/8 5

BEREZIN, B.D. (Ivanov)

Metal phthalocyanines in solution. Part 5: Stability of free
phthalocyanine in sulfuric acid solutions. Zhur.fiz.khim.
35 no.11:2494-2500 N. '61. (MIRA 14:12)

1. Ivanovskiy khimiko-tehnologicheskikh institut.
(Phthalocyanine)

A study of metal phthalocyanines ...

S/076/61/035/011/005/013
B140/B147

Chem. Revs., 16, 67, 1935; W. Gaughey, A. Corvin, J. Amer. Chem. Soc.,
77, 1509, 1955.

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskiy institut (Ivanovo
Institute of Chemical Technology)

SUBMITTED: March 16, 1960

Card 5/5

A study of metal phthalocyanines ...

S/076/61/035/011/005/013
B140/B147

calculated and found to be $1.12 \cdot 10^{-4} \text{ hr}^{-1}$ which inserted in Eq. (2) yields $-\frac{d[\text{H}_2\text{Pc}]}{dt} = 1.12 \cdot 10^{-4} \text{ c H}_2\text{Pc}^{\text{c}} \text{H}_3\text{O}^+$ (6). Reaction (4), in which 4 protons participate, is assumed to involve the shifting of 2 electrons from the H_2Pc macroring to 2 protons with evolution of H_2 gas. The hydrolytic decomposition of H_2Pc is not affected by O_2 or light. At $\text{H}_2\text{SO}_4 \leq 16$ moles the rate of solution of H_2Pc is smaller than the rate of hydrolysis so that the reaction does not reach equilibrium state. At $\text{H}_2\text{SO}_4 \geq 17$ moles the rate of hydrolysis is smaller so that an equilibrium is reached after 1 - 2 hr. It may therefore be assumed that in 17 - 18.8 M $\text{H}_2\text{SO}_4 \rightleftharpoons \text{H}_2\text{PcH}^+ + \text{HSO}_4^-$ is given by $-\log [\text{H}_2\text{Pc}]_{\text{H}_2\text{SO}_4} = 1.67 + \text{H}_0$.

+8.56. N. I. Sosnikova assisted in the experiments. There are 4 figures, 2 tables, and 11 references: 5 Soviet and 6 non-Soviet. The three most recent references to English-language publications read as follows: P. Barrett, C. Dent, R. Linstead, J. Chem. Soc., 1719, 1936; L. Hammett, Card 4/5

A study of metal phthalocyanines ...

S/076/61/035/011/005/013
B140/B147

the same way as the decomposition of H_2Pc . According to Hammett, the H_3O^+ concentration may be calculated as follows:

$pH_0 = \text{const} + \log \frac{HSO_4^-}{H_2SO_4}$ (3), where $\text{const} = -8.56$. It was found experimentally that the H_3O^+ concentration and k_r pass through a maximum at an H_2SO_4 concentration of 14 - 14.5 moles. The author assumes the reaction $H_2PcH^+ + 3H^+ \rightleftharpoons [H_2PcH_4]^{4+}$. Continuous uptake of H^+ leads to rupture of the macroring which in turn results in further hydrolytic decomposition of the H_2Pc : $[(C_8H_4N_2)_4H_6]^{4+} \xrightarrow{8H_2O} 4C_8H_5O_2N + 4NH_4^+ + H_2$ (4). To determine the reaction order of the hydrolytic decomposition of H_2Pc , $\log k_r$ was plotted versus $\log H_3O^+$. Thus, the author obtained the linear

function $\log k_r = \log k + n \log [H_3O^+]$ (5), where $n = 5$ for $H_2SO_4 < 16$ moles/liter, and $n = 4$ for $H_2SO_4 > 16$ moles / liter. From (5), k_r was

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A study of metal phthalocyanines ...

S/076/61/035/011/005/013
B140/B147

tion. The decomposition of H_2Pc in acid solution yields the same products as are obtained by its oxidation (phthalimide and ammonium salts). The influence of atmospheric oxygen and light (using a 1000 w bulb) on the decomposition rate of H_2Pc was also studied. Evaluation of the measurement results showed that the decomposition rate of H_2Pc increases with increasing H_2SO_4 concentration up to a maximum and then decreases rapidly. A 17.65 M H_2SO_4 solution still gave a distinct H_2Pc spectrum. Graphic evaluation yielded the linear function $\log(c_0/c) = f(t)$, ($t = \text{time}$), where c_0 denotes the initial H_2Pc concentration, and c the concentration in the course of the reaction. Therefore this function follows the kinetic equation $-(dc/dt) = k_r c_{H_2Pc}$ (2), where $k_r = \text{hydrolysis rate constant}$. The characteristic decomposition reaction of H_2Pc in H_2SO_4 is assumed to involve the participation of H_3O^+ , since the H_3O^+ concentration changes in

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S/076/61/035/011/005/013
B140/B147

AUTHOR: Berezin, B. D.

TITLE: A study of metal phthalocyanines in solution. V. The stability of free phthalocyanine in sulfuric acid solutions

PERIODICAL: Zhurnal fizicheskoy khimii, v. 35, no. 11, 1961, 2494 - 2499

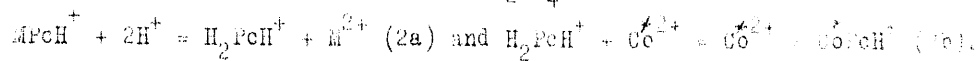
TEXT: The stability of free phthalocyanine (H_2Pc) in H_2SO_4 solution was studied. Experimental procedure: Free H_2Pc is prepared by treating Na_2Pc with 96% H_2SO_4 and introducing the mixture into an ice-bath prepared from distilled water. To remove impurities, H_2Pc was heated with acetone. The stability of the H_2Pc macroring was studied using weighed portions of H_2Pc and various H_2SO_4 concentrations. The optical density of the solutions was measured at regular intervals on a KM(KM) spectrophotometer ($\lambda = 520 \text{ m}\mu$). 12.5 - 17.65 M H_2SO_4 solutions were used for the investiga-

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Study of the stability of ...

S/078/61/006/012/002/011
B110/B147

author studied the isotopic exchange of Co^{2+} -60 with Pc of Co , Ni , Zn , and Al dissolved in 17.20 moles of H_2SO_4 following the equations



Although insoluble H_2Pc and hydrated cations unable to penetrate through the Pc "window", are not formed in (2a) and (2b) as in (1). H_2Pc can separate from (2a) and (2b) due to the slow-rate process. The author thanks N. I. Sosnikova for help with the experiments. There are 3 figures, 3 tables, and 22 references; 12 Soviet and 10 non-Soviet. The three most recent references to English-language publications read as follows: B. West, J. Chem. Soc., 3115 (1957); D. Atkins, C. Garner, J. Amer. Chem. Soc., 74, 3527 (1952); W. Caughey, A. Corwin, J. Amer. Chem. Soc., 77, 1509 (1955)

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskii institut Kafedra analiticheskoy khimii (Ivanovo Institute of Chemical Technology, Department of Analytical Chemistry)

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S/078/61/006/012/002/011
B110/B147

Study of the stability of ...

activity of the solution was determined (Table 3). Irreversibility of (1) in acid aqueous solutions may be assumed on the basis of examinations by the usual solubility method of the dissociation of less stable Pc of Mg, Ca, Cd, Hg, Ag, Pb, and Fe. Even with the stable compound ClFePc, complete "washing out" of the metal with 1 mole of acid occurred after 8 - 10 days, with MgPc and PbPc it occurred after 40 - 50 hr, with AgHPc after 120 hr, with HgPc and CdPc after 12 - 15 hr, and with CaPc after 2 - 3 hr. The rate of washing depends on the type of central ion. It increases as the acid concentration increases, but it is quantitatively independent of the H ion concentration. It probably depends on the different rates of rupture of the donor - acceptor bond between metal and addendum. Presumably, it is the higher the lower the covalent character of the metal - addendum bond. It is due to residual basic properties of inner-cyclic N atoms of the macro-ring, since the basic properties of the addendum decrease as the firmness of the σ -bond of metal - nitrogen increases. As regards filling of the hybrid orbit of the metal ion by electron pairs of nitrogen, the following sequences of bond firmness are given: $Fe^{3+} > Ag^+ > Mg^{2+}$, $Pb^{2+} > Cd^{2+}$, $Hg^{2+} > Ca^{2+}$. The

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3,078/61/006/012/002/011
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of Be^{2+} from MPC proceeded more slowly than that of Mg^{2+} and other ions of less stable Pc except for Fe^{3+} , since the rates of its hydrolysis at 25°C in 17.70 and 15.40 moles of H_2SO_4 are $0.095 \pm 0.008 \text{ hr}^{-1}$ and

$1.40 \pm 0.06 \text{ hr}^{-1}$, respectively. To study the stability of stable Pc, Co^{2+} and Zn^{2+} were formed from an alcoholic anhydrous solution of $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$.

$\text{ZnCl}_2 \cdot 6\text{H}_2\text{O}$, and Li_2Pc in absolute alcohol. They were mixed by anking with equal amounts of titrated H_2SO_4 (1 - 8 moles/liter), at 25 or 50°C and the activity of the solution was determined after centrifuging. The activity of the deposit was 20,000 pulses/min. A known volume of a Co^{60} salt dissolved in H_2SO_4 of the same concentration (17.20 moles/liter) was added to sulfuric Pc solutions of Al, Co, Ni, and Zn contained in a bulb.

Hydrolysis was conducted according to $\text{MPC}^{\text{H}^+} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{MPC}_{\text{OH}}$.

Reprecipitated dried MPC was dissolved in concentrated H_2SO_4 and the

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S/076/61/006/012/002/011
B110/B147

AUTHOR: Berezin, B. D.

TITLE: Study of the stability of phthalocyanines of metals in solution

PERIODICAL: Zhurnal neorganicheskoy khimii, v. 6. no. 12, 1961, 2672-2679

TEXT: The author studied less stable phthalocyanines of metals by the solubility method, and stable ones by means of isotopic exchange. The decomposition of less stable Pc follows the reaction $MPC_{sol} + 2H_3O^+ = M_{aq}^{2+} + H_2PC^{sol}$.

An exact MPC addition was shaken with H_2SO_4 , HCl , or $HClO_4$ in the thermostat at $25 \pm 0.2^\circ C$. Next, the Ag^+ content in the filtrate was nephelometrically determined as $AgCl$. Hg^{2+} was determined with diphenyl carbazona, Co^{3+} was determined as rhodanide in an HNO_3 medium, Mg^{2+} , Ca^{2+} , Cr^{2+} , and Sb^{2+} were titrimetrically determined by means of eriochrome black. The separation

Card 1/0 4

EEREZIN, B.D.

Stability of metal phthalocyanines in solution. Zhur.neorg.khim.
6 no.12:2672-2679 D '61. (MIRA 14:12)

1. Ivanovskiy khimiko-tehnologicheskoy institut, kafedra analiti-
cheskoy khimii.

(Phthalocyanine)

BEREZIN, B.D.

Metal phthalocyanines in solutions. Part 4: Effect of the central ion charge and of substituted derivatives on the properties of phthalocyanines. Izv.vys.ucheb.zav.;khim.i khim.tekh. 4 no.3:379-386 '61. (MIRA 14:10)

1. Ivanovskiy Khimiko-tekhnologicheskii institut, kafedra analiticheskoy khimii.
(Phthalocyanine)

21124

Study of phthalocyanines of ...

S/153/61/004/001/003/009
B110/B203

Legend to Fig. 5: Absorption
spectra CoPc and CuPcCl_{15} ;

- (1) CoPc in 18 M H_2SO_4 ;
- (2) CoPc in 15 M H_2SO_4 ;
- (3) CuPcCl_{15} in 18 M H_2SO_4 .

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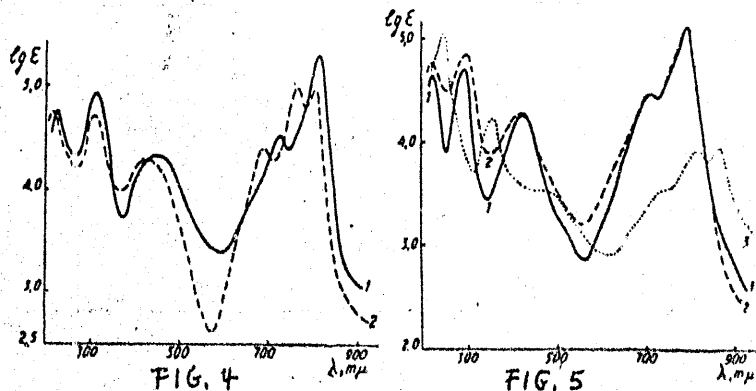
X

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Study of phthalocyanines of ...

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B110/B203

Legend to Fig. 4: Absorption
spectra of $\text{HSO}_4 \cdot \text{AlPcCl}$;
(1) in 18 M H_2SO_4 ; (2) in
14 M H_2SO_4 .



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Study of phthalocyanines of ...

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Legend to Fig. 1: Absorption
spectra of CuPc and H₂Pc;

- (1) CuPc in 18 M H₂SO₄;
- (2) CuPc in 15 M H₂SO₄;
- (3) CuPc in α -C₁₀H₇Cl;
- (4) H₂Pc in α -C₁₀H₇Cl.

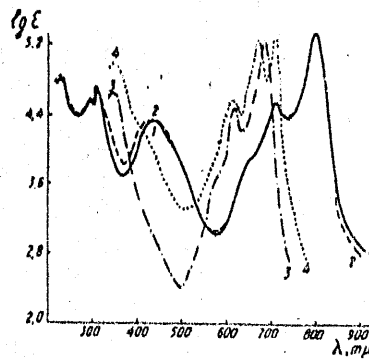


FIG. 1

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B110/B203

Legend to Table 2: Position of main electron transitions in solutions of MePc in α -C₁₀H₇Cl; (a) electron transitions, (b) phthalocyanine.

Электронные переходы	Фталоцианин			
	I	II	III	IV
Фталоцианин	λ_{max}, μ			
H ₂ Pc	700	665	605	350
CuPc	680	—	614	346
NiPc	676	—	602	—
CoPc	672	—	604	—
ZnPc	680	—	601	345
Cl·AlPc	691	—	622	—

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V		VI		VII	
λ_{max} , m μ	Ig ϵ	λ_{max} , m μ	Ig ϵ	λ_{max} , m μ	Ig ϵ
290	4,56	225	4,82		
287	4,61	224	4,86		
291	4,56	224	4,83		
		226	4,77		
		224	4,68		
		223	4,66		
		222	4,65		
		222	4,79		
		222	4,82		
		229	4,95		
		230	4,86		
		225	4,76		
		222	4,73	765	4,92
		221	4,78	760	4,98
				820	3,93
		232		690	

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Study of phthalocyanines of ...

С Электронные переходы

	II		III		IV	
	$\lambda_{max}, m\mu$	$\lg \epsilon$	$\lambda_{max}, m\mu$	$\lg \epsilon$	$\lambda_{max}, m\mu$	$\lg \epsilon$
705	—	4,56	440	4,32	295	4,72
704	—	4,56	440	4,36	306	4,75
700	—	4,49	440	4,28	305	4,72
690	—	4,18	—	—	302	4,61
700	—	4,10	—	—	300	4,51
700	—	3,95	—	—	300	4,50
700	—	4,48	427	4,27	291	4,72
700	—	4,48	422	4,32	298	4,84
700	—	4,37	420	4,37	300	4,81
700	—	4,50	440	4,26	310	4,83
698	—	4,46	440	4,12	310	4,78
720	—	4,52	463	4,36	312	4,95
разный	—	—	435	4,41	315	5,20
686	—	4,30	430	4,32	307	4,73
—	—	—	350	4,24	245	5,05
775	—	—	430	—	305	—

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X

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S/153/61/004/001/003/009
B110/B203

Study of phthalocyanines of ...

ASSOCIATION: Ivanovskiy khimiko-tekhnologicheskii institut. Kafedra analiticheskoy khimii (Ivanovo Institute of Chemical Technology, Department of Analytical Chemistry)

SUBMITTED: May 11, 1959

Legend to Table 1: Position of electron transitions λ_{max} and their intensity in sulfuric acid solutions of MePc; (a) phthalocyanine, (b) concentration H_2SO_4 , moles/liter; (c) electron transitions.

Фталоцианин	Концентрация H_2SO_4 , мол./л.	I	
		λ_{max} , мμ.	I _{гс}
CuPc	17,66	794	5,36
	15,75	792	5,38
	13,80	792	5,39
NiPc	17,44	778	4,57
	14,00	774	4,51
	13,40	774	4,42
CoPc	17,88	790	5,12
	15,00	782	5,09
	13,80	780	5,82
ZnPc	17,44	788	5,32
	14,00	784	5,28
H ₂ O: AlPcCl ₃	17,88	810	5,29
	15,27	802	5,07
	13,75	794	4,99
CuPcCl ₃ : H ₂ O	17,44	865	3,96
	17,44	840	—

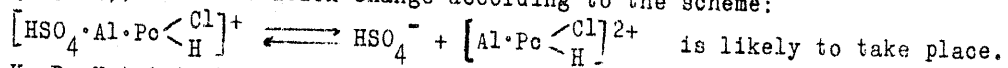
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B110/B203

Study of phthalocyanines of ...

$\text{CuPcCl}_{15}\text{H}^+$ red-brown. Desolvation of MePcH^+ effects a slight change of λ_{max} as well as of the absorption intensities by interaction of the proton with nitrogen, and, thus, a stronger polarization effect on the π -cloud of the macrocycle. This explains the weak bathochromic shift with increasing H_2SO_4 concentration. The latter has, however, no influence on the position of absorption maxima, which excludes the addition of a second proton to the MePcH^+ , and proves their existence as monovalent bases at any acid concentration. In the aluminum complex (Fig. 4), a dissociation change according to the scheme:



K. B. Yatsimirskiy is mentioned. There are 5 figures, 2 tables, and 18 references: 8 Soviet-bloc and 10 non-Soviet-bloc. The two references to English-language publications read as follows: R. Williams: Chem. Revs., 56, 299 (1956); W. Caughey, A. Corwin: J. Amer. Chem. Soc. 77, 1509 (1955).

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2112h

S/153/61/004/001/003/009
B110/B203

Study of phthalocyanines of ...

values for the bonding strength metal - addendum, and for the position and intensity of maxima, are likely to give similar sequences. Table 1 shows for λ_{\max} of the MePcH^+ the order: $\text{H}_2\text{Pc} > \text{AlPcCl} > \text{CuPc} > \text{CoPc} > \text{ZnPc} > \text{NiPc}$, which agrees well with values of the mesoporphyrine complexes: Zn^{2+} (570 m μ) $>$ Cu^{2+} (561 m μ) $>$ Co^{2+} (552 m μ) $>$ Ni^{2+} (550 m μ). Also here, the Ni complex for which maximum stability is assumed shows the minimum value. The irregularity of ZnPcH^+ is explained as follows: The order of the MePcH^+ with respect to the π -electron density does not agree with the order of the MePcH^+ with respect to λ_{\max} , since the same π -electron density of the macrocycle may result from different fractions of σ - and π -bonds, which, in turn, have different effects on the λ_{\max} shift. Also the transition intensity $\log \epsilon$ is not simply dependent on electron density. Polarization of bonds of benzene nuclei and the macrocycle in CuPcCl_{15} (Fig. 5) effects alleviation of transitions in the macrocycle as well as between the conjugate systems macrocycle - benzene nuclei; maxima are bathochromically shifted: CuPcCl_{15} is green,

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Study of phthalocyanines of ...

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symmetric molecule whose π -electron system is stabilized by double $p_{\pi}-d_{\pi}$ bonds of the central ion with the addendum. New maxima are not formed, the metal ion is not chromophorous, since the weak transitions on the d-electron shells do not appear in the spectrum. Thus, the nature of transitions and the ionic structure are equal, in principle, for protonized H_2Pc and $MePcH^+$. The spectral shift (color change: deep green \rightarrow yellowish brown) observed in protonized H_2Pc after standing for 48 hr is being studied now. On introduction of the covalent metal ion, 4 σ bonds of the central ion are formed at the expense of the completing of ion levels $3d4s4p^2$ (Co^{2+} , Ni^{2+} , Cu^{2+}); $4d4s4p^2$ (Zn^{2+}); $3d3s3p^2$, or higher levels (Al), by electrons of unbound electron pairs of intracyclic N atoms. Then, two simple oscillating π -bonds are formed with the π -cloud of the addendum by the d_{zx} and d_{zy} electron orbits of the metal ions unless they have been claimed by σ -bonds. The author had already established an increase of the π -electron density in the order: $CuPcCl_{15} < ^+AlPcCl < CoPc(ZnPc) < CuPc < NiPc < H_2Pc$. The

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Study of phthalocyanines of ...

the intracyclic N atoms have lost the noncovalent electron pairs by complex formation. A $\pi_C \rightarrow \pi_N$ (3), and a $\pi_N \rightarrow \pi_C$ (4) transition are likely to occur in MePc. (3) corresponds to minimum exciting energy and produces the longwave absorption band. In (4), part of the π -cloud passes from the more electronegative N to C, which produces the less intensive, longwave band. The $\pi_C \rightarrow \pi_C^*$ electron transition from the conjugate benzene system to the macrocycle system may produce the absorption band in the adjacent ultraviolet range. Due to the high autonomy of the two systems, nearly 80 kcal are required to this end. Besides, a transition from the macrocycle to the benzene ring, and a $\pi_C \rightarrow \pi_C^*$ transition in the substituted benzene ring are also possible. Protonization does not interfere with conjugation in the macrocycle, but it strongly polarizes the π -electron cloud by positive charge. Thus, this cloud becomes very mobile, and may be even excited by low-energy photons. Colors are deepened, and maxima are bathochromically shifted according to the color theory. On introduction of metals in the Pc molecule, the intensity of maxima drops, probably due to the formation of a perfectly

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Study of phthalocyanines of ...

of absorption bands. Co, Ni, Cu, and Zn salts dissolved in 8-10 M H_2SO_4 are assumed to have monovalent, basic character: $(MePc)_{dis} + H_2SO_4 \rightleftharpoons MePcH^+ + HSO_4^-$. Thus, metal salts protonized in H_2SO_4 solution can be studied in the spectrum for rules basing on the exchange of metals and substituents in the complex, on charges in the central ion, etc. The proton bound in H_2SO_4 solution to the conjugate ring system does not change the character of electron transitions but their probability (bathochromic shift = 80-120 $m\mu$, drop in excitation energy: infrared range 5-6 kcal, ultraviolet range = 16 kcal). This, and similar conditions for other MePc (Tables 1 and 2), is explained as follows: $n \rightarrow \pi^*$ (1) and $\pi \rightarrow \pi^*$ (2) transitions are possible in the Pc molecule. In (1), an unbound electron passes from the noncovalent pair of N atoms to the shell of the π -electron cloud of the macrocycle. In (2), a π -electron within the conjugate system passes from the electron shell of one atom to that of another atom. In Pc molecules, probably only (2) exists, since electron spectra of phthalocyanines and porphyrines are very similar. In metal pheophytinates, (2) is no longer possible since

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21124

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also 4112

S/153/61/004/001/003/009
B110/B203AUTHOR: Berezin, B. D.TITLE: Study of phthalocyanines of metals in solutions.
III. Absorption spectra of phthalocyanines in sulfuric acid solutions

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimicheskaya tekhnologiya, v. 4, no. 1, 1961, 45-52

TEXT: To study photosynthetic and biological reaction chemisms in the living organism, the absorption spectra of porphyrine derivatives are very important for their identification. In the present study, the author uses strong sulfuric acid solutions of stable metal phthalocyanines: chemically pure Cu, Zn, Co, Ni salts, $H_2SO_4 \cdot AlPcCl$ (according to Linstead), $CuPcCl_{15}$, and free H_2Pc . Sulfuric acid solutions with strong H_2SO_4 of known titer were prepared. The absorption spectra in the ultraviolet, visible, and adjacent infrared spectrum ranges were taken at 22-24°C by an $C\Phi-4$ (SF-4) spectrophotometer. Table 1 gives maxima and intensities

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BEREZIN, B.D.; POGODINA, L.G.

Phloroglucinol as an indicator in mercurimetry. Zav. lab. 26 no. 12:
1347-1351 '60. (MIRA 13:12)

L. Ivanovskiy khimiko-tehnologicheskii institut.
(Phloroglucinol) (Mercurimetry)

SOV/153-2-2-4/31
Investigation of the Metallic Phthalocyanines in Solutions. II. Acidic-alkaline Interaction of the Phthalocyanines of Some Metals in Sulphuric-acid Solutions

X-ray structural data, as well as with the chemical and physico-chemical properties of the phthalocyanines. K. B. Yatsimirskiy read the manuscript. V. F. Borodkin supplied the phthalocyanine preparations. There are 2 figures, 2 tables, and 9 references, 3 of which are Soviet.

ASSOCIATION: Ivanovskiy khimiko-tehnologicheskii institut; Kafedra analiticheskoy khimii
(Ivanovo Chemical-technological Institute; Chair of Analytical Chemistry)

SUBMITTED: January 9, 1958

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SOV/153-2-2-4/31

Investigation of the Metallic Phthalocyanines in Solutions. II. Acidic-alkaline Interaction of the Phthalocyanines of Some Metals in Sulphuric-acid Solutions

4 metals mentioned before as well as for H_2Pc were computed (1). Tables 1 and 2 show the indices of these constants (computed by formula 4). The pK_{MPC} -values keep a good constancy over a considerable range of acidity. For a perfect confirmation of his assumptions and computations, the author determined the solubility of $CuPc$ and $CoPc$ in 16.70 m H_2SO_4 and of $ZnPc$ in 17.25 m H_2SO_4 . It is in good agreement with the values computed by equation (4). So it can be assumed that equation (4) only applies to H_2SO_4 up to 100% concentrations. This equation is useless for oleum since stronger acids, such as $H_3SO_4^+$ et al (Ref 7), are present in it. From the experimental results of the present paper, one can make theoretical conclusions which are connected with the dependence of the MPC-solubility on the nature of the metal. On the basis of his investigation of the phthalocyanine properties, the author suggests modified structure formulas of the free phthalocyanine and its covalent complex salts (Fig 2). They are in good agreement with the

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SOV/153-2-2-4/31

Investigation of the Metallic Phthalocyanines in Solutions. II. Acidic-alkaline Interaction of the Phthalocyanines of Some Metals in Sulphuric-acid Solutions

they lead to formulas which are useful for the practical computation of the dissolution of phthalocyanine dyes in H_2SO_4 (and other concentrated acids) in their industrial purification. The derivation of the mentioned formulas is based on the fact that 4 peripheral, so-called extracyclic, nitrogen atoms are present in the molecule. They carry free electron pairs which give the phthalocyanines the properties of very weak bases. In the opinion of the author, this is due to the participation of free electron pairs of the extracyclic nitrogen atoms in the composition of a metalline molecule (Ref 2). The author assumes that the metallic phthalocyanines can only absorb one proton in a noticeable degree. This proton considerably weakens the basic properties of the $MPcH^+$ as it intensely deforms the π -electron cloud of the conjugate large ring in the direction of the absorbed proton. This assumption was well confirmed by the experimental results of the present paper. From the data on the solubility, the equilibrium constants K_{MPc} for the reaction (II) for the phthalocyanines of the

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