BURIJAN, Jovan; JANCIC, Marija S.; RODIC, Sofija; BANKOVIC, Stanoje

Determination of gastric juice acidity without a catheter. Srpski arh. celok. lek. 89 no.5:593-596 My '61.

1. Interna klinika A Medicinskog fakulteta Univerziteta u Beogradu. Upravnik: prof. dr Branislav Stanojevic.

(GASTRIC JUICE)

RODIC S.

VRCELJ, Stefanija, dr.; RODIC, Sofija, dr.

Dystrophic edema in the course of intestinal disorders caused by Lambliae. Srpski arh. celok. lek. 82 no.7-8:998-1003 July-Aug 54.

1. II Interna klinika Medicinskog fakulteta u Beogradu, upravnik: doc.dr. Djordje Brkic.

(GIARDIASIS, compl.
edema, dystrophic)
(EDEMA
dystrophic, caused by giardiasis)

RODIC, SOFIYA

BRKIC, Djordje; RODIC, Sofija

Is histamine the strongest stimulant for hydrochloric acid secretion? Srpski arh. celok. lek. 85 no.5:547-551 Mar 57.

1. Interna klinika A Medicinskog fakulteta u Beogradu. Upravnik: Branko Stanojevic.

(HISTAMINE, eff.
on hydrochloric acid secretion (Ser))
(HYDROCHLORIC ACID,
secretion, eff. of histamine (Ser))

JEVTIC, Zivojin; BURIJAN, Jovan; BROCIC, Mladen; RODIC, Sofija

Unusual nervous manifestations in leukoses; three case reports.
Srpski arh. celok. lek. 85 no.2:245-250 Feb 57.

1. II Interna klinika Medicinskog fakulteta u Beogradu. Upravnik:
prof. dr. Djordje Brkic.
(LEUKEMIA, compl.
neurol (Ser))
(NERVOUS SYSTEM, dis.
in leukemia, case reports (Ser))

BURIJAN, Jovan, doc., dr.; TUFEGDZIC-LJALJEVIC, Jasmina, dr.; RODIC, Sofija, dr.; MICIC, Jovan, dr.; JANCIC, Marija, dr.

Local application of hydrocortisone in the treatment of ulcerative colitis. Med. glasn. 14 no.11:513-515 N '60.

1. Interna klinika "A" Medicinskog fakulteta u Beogradu (Upravnik: prof. dr. B. Stanojevic).

(HYDROCORTISONE ther) (COLITIS ULCERATIVE ther)

RODICH, S.

YUGOSLAVIA/Human and Animal Physiology. The Nervous System. V

Abs Jour: Ref. Zhur-Biol., No 6, 1958, 27322.

Author : Zhivoyin Yevtich, Yovan Buriyan, Mladen Brochich and Sofiya Rodich.

Inst :

Title : Rarely Encountered Neurological Manifestations of Leukemia (In Relation to Three Cases).

Orig Pub: Srpski arkhiv tselok. lekar., 1957, 85, No 2, 245-250.

Abstract: No abstract.

Card : 1/1

YUGOSLAVIA

BURIJAN, Jovan, Dr, prof, ANDREJEVIC, Milan, Dr, BANKOVIC, Stanoje, Dr, RODIC, Sofija, Dr; Department A of the Internal Clinic for Internal Medicine, Faculty of Medicine, University of Belgrade (Interna klinika A Medicinskog fakulteta, Univerziteta u Beogradu) (Head: STANOJEVIC, B., Dr, prof), Belgrade.

"Digestive Bleeding as an Urgent Medical Problem at the Internal Clinic "A" Over a Ten-year Period"

Belgrade, Medicinski Glasnik, Vol 19, No 11-12, Nov-Dec 1965, pp 340-342

Abstract: Of 315 patients with digestive bleeding, 50% had gastroduodenal bleeding. Digestive bleeding in acute form presents a serious medical problem which requires effective and urgent therapy. One part of the problem is tehnical, the necessity to provide hospitalization and sufficient amounts of blood for the patients. The second part of the problem is the differing attitudes between the surgical and internal departments as to how and where to treat the patients. It is necessary to provide close cooperation between surgeon and internist in all cases where the illness can be treated by both. No references.

1/1

YUGOSLAVIA/ Pharmacoloty and Toxicology. Histamine and Antihistamine Drugs. V-4

Abs Jour : Ref Zhur - Biol., No 16, 1958, No 75773

Author : Brkich, Borche; Rodich, Sofija.
Inst : Not given
Title : Whether of Not Histamine is the Most Powerful Stimulator for Causing the Excretion of Hydrochloric Acid.

Orig Pub : Srpski arkhiv tselok. lokar., 1957, 85, No. 5, 547-558

Abstract : In 30 patients with achlorhydria determined by the Boas Ewald method, anacidity was found even after the introduction of caffeine or histamine. The majority of the patients with histamine-resistant achlorhydria (HRA) had the lowest both after mechanical stimulation by probe during the night and under the influence of ACTH or a caffeine solution. In 3 patients with HRA in secretion, HCl was found in the contents obtained during evening evacuation after parenteral

Card 1/2

KARAKIN, F.F.; RODICHEV, A.F.; PUTIY, G.P.; BASOV, A.P.; PYATAKOV, L.V.; RAUTSEP, A.P. [Rautsepp, A.]; BLAGONRAVOV, S.I.; GRECHIKHO, A.M.; DRUZHININ, N.N.; SHUKHMAN, D.I.; BAUSIN, A.F.; LOYKO, P.G.; CHERNAKOV, B.A.; SHORNIKOV, F.M.; SOPIN, P.F.

Remarks of the members of the Conference. Torf. prom. 37 no.5: 22-28 '60. (MIRA 14:10)

1. Ivanovskiy gosudarstvennyy torfotrest (for Karakin). 2. Sverdlovskiy torfotrest (for Rodichev). 3. Gosplan USSR (for Putiy). 4. Leningradskiy gosudarstvennyy trest torfyanoy promyshlennosti (for Basov). 5. Moskovskiy oblastnoy sovnarkhoz (for Pyatakov). 6. Gosudarstvennyy nauchno-tekhnicheskiy komitet Estonskoy SSR (for Rautsep). 7. Gor'kovskiy sovnarkhoz (for Blagonravov). 8. Belorusskiy sovnarkhoz (for Grechikho, Shukhman). 9. Yaroslavskiy sovnarkhoz (for Druzhinin). 10. Bobruyskaya mashinno-meliorativnaya stantsiya (for Loyko). 11. Gipromestprom Gosplana RSFSR (for Chernakov). 12. Mezhkolkhoznoye torfopredpriyatiye "Volosovskoye" Leningradskoy oblasti (for Shornikov). 13. Vsesoyuznyy nauchno-issledovatel'skiy institut torfyanoy promyshlennosti (for Sopin).
(Peat industry)

RODICHEV, A-F

ALEKSEYEV, Ye.T.; APENCHENKO, S.S.; BASOV, A.P.; BAUSIN, A.F.; BERSHADSKIY, L.S.; VELLER, M.A.; GINZBURG L.N.; GUSEV, S.A.; DANILOV, G.V.; DOLGIKH, M.S.; DRUZHININ, N.N.; YEFIMOV, V.S.; ZAVADSKIY, N.V.; IVASHECHKIN, N.V.; KARAKIN, F.F.; KUZHMAN, G.I.; LOBANOV, S.P.; MERKULOV, Ya.V.; NIKODIMOV, P.I.; PANKRATOV, N.S.; PYATAKOV, L.V.; RODICHEV, A.F.; SMIRNOV, M.S.; STRUKOV, B.I.; SAVOCHKIN, S.M.; SAMSONOV, N.N.; SINITSYN, N.A.; SOKOLOV, A.A.; SOLOPOV, S.G.; CHELYSHEV, S.G.; SHCHEPKIN, A.Ye.

Fedor Nikolaevich Krylov; obituary. Torf. prom. 35 no.6:32 '58.
(MIRA 11:10)

(Krylov, Fedor Nikolaevich, 1903-1958)

RODIONOV, A.M.

Calculation of the operational the induced e.m.f. in cyclic [illegible] reversal of ferromagnetic substances. Izv. vys. [illegible] Rev. radiofiz. 4 no.3:577-579 '61. (MIRA 14:10)

1. Nauchno-issledovatel'skiy institut fizicheskikh issledovaniy pri Gor'kovskom gosudarstvennom universitete imeni N.I. Lobachevskogo.
(Ferrites)

RODICHEV, A.M.; KHLEBOPROS, L.G.

Allowing for magnetoelastic bonding in the shifting of a magnetic moment. Fiz. tver. tela 7 no.1:274-276 Ja '65. (MIRA 18:3)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR, Krasnoyarsk.

RODICHEV, Yu.M.

Motion of the magnetic moment. Zhur. eksp. i teor. fiz. 48 no.3:860-863 Mr '65. (MIRA 18:6)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

L 15380-66 EWT(1)/EWP(e)/EWT(m)/EWA(d)/T/EWP(t)/EWP(z)/EWP(b) LIP(c) JD/GG

ACC NR: AP6004457 SOURCE CODE: UR/0048/66/030/001/0017/0018

AUTHOR: Salanskiy, N.M.; Rodichev, Yu.M.

ORG: Institute of Physics of the Siberian Section of the Academy of Sciences, SSSR (Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR)

TITLE: Measurement of the loss angle incident to magnetization of a thin ferromagnetic film in a rotating field /Transactions of the Second All-Union Symposium on the Physics of Thin Ferromagnetic Films held at Irkutsk 10 July to 15 July, 1964/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 30, no. 1, 1966, 17-18

TOPIC TAGS: ferromagnetic film, magnetic thin film, permalloy, high frequency, rotating magnetic field, loss angle,

ABSTRACT: The authors have measured the angle θ by which the magnetization of a 1000 Å 80-20 Permalloy film of low anisotropy lagged behind the 5.5 MHz rotating magnetizing field. The measurements were made with the apparatus described in another report to the present Symposium by A.I.Pol'skiy and N.M.Salanskiy (Izv. AN SSSR Ser. fiz., 30, 19 (1966) /see Abstract AP6004458/). After balancing the system in the absence of the film as described in the cited reference, the film was introduced and the compensating coil was rotated until the signal was minimum. From the angle through which the compensating coil was rotated and the relative strengths of the signals received with the compensating coil in different positions, the lag angle θ

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ACC NR: AP6004457

was calculated. Measurements were made in fields ranging from 2 to 6 Oe; these fields were sufficiently strong so that the entire film participated in magnetization rotation. An average value of approximately 1.5 was found for the quantity $a + bf^2$ in the expression $\Theta = \sin^{-1}(f(a + bf^2)/\gamma H)$, where f is the angular velocity of the rotating field of strength H, γ is the gyromagnetic ratio, and a and b are constants. This value is considerably greater than was found at superhigh frequencies by the ferromagnetic resonance method (no reference cited). This discrepancy may be due in part to proximity to the vibrational resonance discussed by A.M.Rodichev and R.G.Khlebopros (Izv. AN SSSR Ser. fiz., 30, 54 (1966)) and in part to hysteresis losses in the substructure. Orig. art. has: 2 formulas and 2 figures.

SUB CODE: 20 SUBM DATE: 00 ORIG. REF: 003 OTH REF: 002

Card 2/2

L 31160-66 EWT(1)/EWP(e)/EWT(m)/EWA(d)/EWP(t) JD/GG
ACC NR: AP6006811 SOURCE CODE: UR/0181/66/008/002/0342/0344

56
3

AUTHOR: Rodichev, A. M.; Khleborpros, R. G.

ORG: Institute of Physics SO AN SSSR, Krasnoyarsk (Institut fiziki SO AN SSSR)

TITLE: Effect of inertia in the magnetic moment on interaction between an electromagnetic field and a magnetic material

18

SOURCE: Fizika tverdogo tela, v. 8, no. 2, 1966, 342-344

TOPIC TAGS: magnetic moment, magnetic metal, electromagnetic interaction, magnetic resonance

ABSTRACT: The authors consider forced precession in a constant magnetic field with a variable circularly polarized field oriented perpendicular to the constant field and rotating with a frequency ω much less than c/r, where r is the linear size of the body. It is shown that resonance phenomena may also be observed when the variable magnetic field rotates in a direction opposite to that of free precession. Formulas are derived for the resonance frequencies. We thank V. A. Ignatchenko for useful consultation. Orig. art. has: 15 formulas.

SUB CODE: 20/ SUBM DATE: 09Jun65/ ORIG REF: 004/ OTH REF: 001

Card 1/1

L 27676-66 EWT(1) IJP(c)

ACC NR: AP6007633 SOURCE CODE: UR/0141/66/009/001/0081/0084

AUTHOR: Rodichev, A. M.

ORG: Institute of Physics, SO AN SSSR (Institut fiziki SO AN SSSR)

TITLE: Behavior of inversed ferromagnetics

SOURCE: IVUZ. Radiofizika, v. 9, no. 1, 1966, 81-84

TOPIC TAGS: ferromagnetic material, ferromagnetic structure

ABSTRACT: The process of changing the magnetization of a uniformly magnetized ferrodielectric sphere by strong fields through near-π angles is theoretically investigated. It is proven that, under certain conditions, the rate of increase in the uniform precession may considerably exceed that of spin waves, and the magnetization is changed by uniform rotation. These conditions are: $\begin{cases} A_k < -4\pi M_0, \\ \operatorname{Re}\Omega_k = -\omega_k. \end{cases}$ They may be satisfied not for the entire spectrum but for a certain k_1 such that the number of waves with $k > k_1$ (with higher energies) is so small that their increase does not appreciably affect the nature of transition of the specimen into its new stable state. Orig. art. has: 1 figure and 17 formulas.

SUB CODE: 20, 09 / SUBM DATE: 17Aug65 / ORIG REF: 005/ OTH REF: 008

Card 1/1 UDC: 538.245

RODICHEV, A.M. [deceased]; KHLEBOPROS, R.G.

Electrodynamic effects occurring due to the shifting of the magnetic moment in a thin film. Izv. AN SSSR. Ser.fiz. 30 no.1:54-58 Ja '66. (MIRA 19:1)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

RODICHEV, A.M. [deceased]

Conservation of uniform magnetization intensity in the magnetic reversal of ferromagnets. Izv. AN SSSR. Ser.fiz. 30 no.1:83-87 Ja '66. (MIRA 19:1)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

LOGUTKO, A.L.; RODICHEV, A.M.; SALANSKIY, N.M.; SMOLIN, R.P.

Measuring the duration of magnetic reversal pulses. Fiz. met. i metalloved. 20 no.2:306-308 Ag '65. (MIRA 18:9)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

L 47368-65 EWT(1)

ACCESSION NR: AP5008744 S/0056/65/048/003/0860/0863

11
10
B

AUTHOR: Rodichev, A. M.

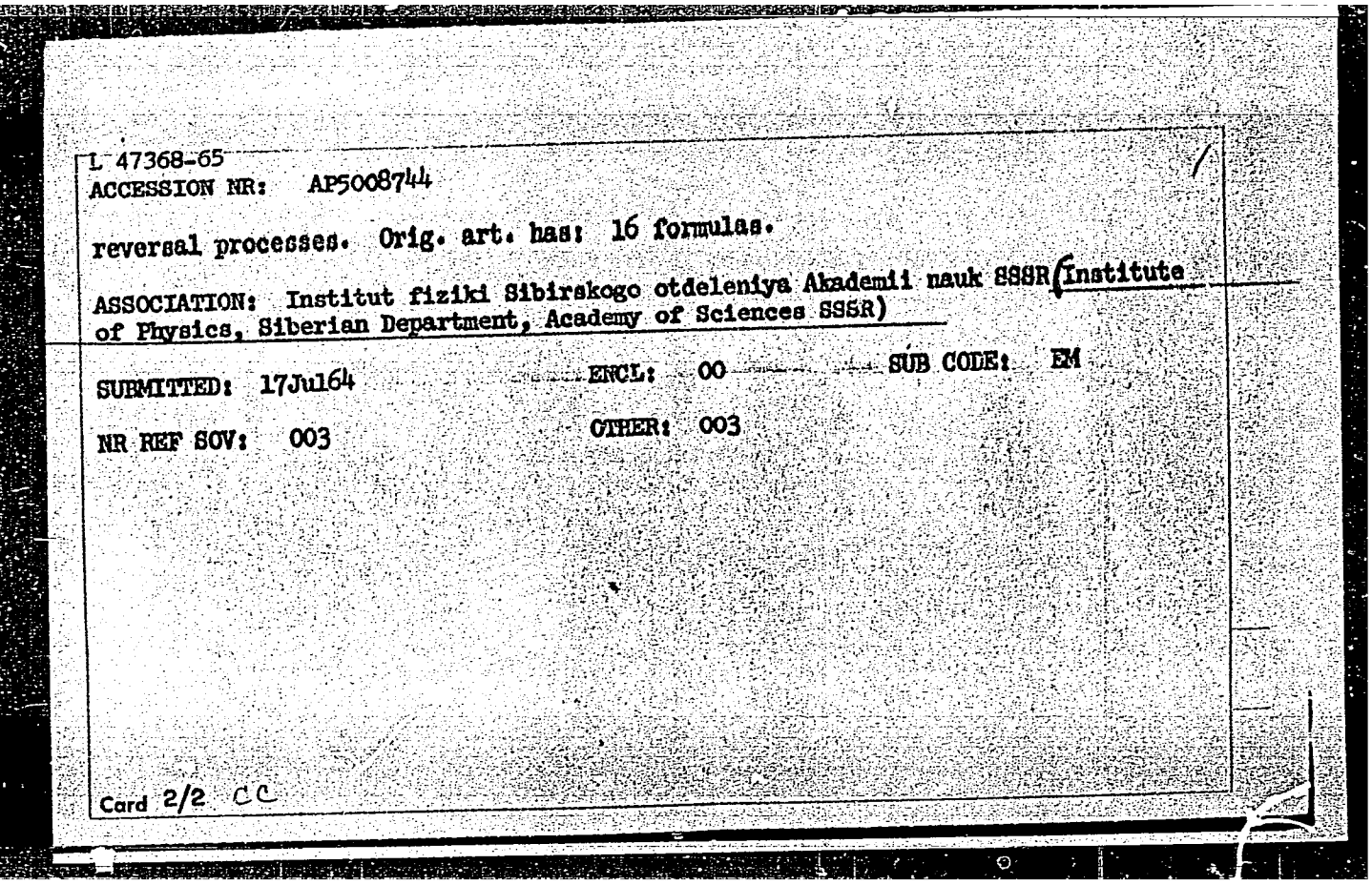
TITLE: Motion of a magnetic moment 21

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 48, no. 3, 1965, 860-863

TOPIC TAGS: magnetic moment, equation of motion, transient process, precession frequency, resonant frequency, magnetization reversal

ABSTRACT: An equation of motion is derived for the magnetic moment, in which the expression for the effective field is obtained with account of energy dissipation and inertia of the magnetic moment. The previously derived equations did not contain inertial terms and therefore could be used only to describe uniform precession (resonance phenomena), but not transient processes. By way of examples, expressions are given for the resonant frequency for a sphere and for the transient occurring in a thin plate upon sudden reversal of magnetization. An order of magnitude estimate shows that the inertial term becomes significant in the case of fast

Card 1/2



L 47368-65
ACCESSION NR: AP5008744

reversal processes. Orig. art. has: 16 formulas.

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics, Siberian Department, Academy of Sciences SSSR)

SUBMITTED: 17Jul64 ENCL: 00 SUB CODE: EM

NR REF SOV: 003 OTHER: 003

Card 2/2 CC

L 56079-65 EWT(1)/EWT(m)/EWP(i)/T/EWP(t)/EEC(b)-2/EWP(b) Pi-4 IJP(c)
JD/GG

ACCESSION NR: AP5013806 UR/0126/65/019/005/0652/0659
538.114 : 539.216.2

35
34
B

AUTHOR: Rodichev, A. M.

TITLE: Motion of the magnetic moment in thin ferromagnetic films

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 5, 1965, 652-659

TOPIC TAGS: magnetic moment, dissipation term, field inertia, magnetic reversal, demagnetizing field, thin ferromagnetic film, thin ferrite plate, uniaxial anisotropy, Landau equation, Lifshits equation

ABSTRACT: The motion of the magnetic moment ($|\mathbf{M}|$ = const) is examined with the object of deriving the equation of motion of the magnetic moment in which the expression for the effective field $\mathbf{H}_{eff}$ is found on taking into account the energy dissipation and the magnetic-moment inertia, this being essential in the case of rapid transient processes. The known equations with dissipation terms in the Landau-Lifshits and Gilbert forms do not completely take into account the inertia of motion. Further, the problem is restricted by the condition of a limited rate of motion of the magnetic moment ($Mc/M \gg 1$, where l is the body's dimension while $\dot{M}$ (and also M, etc.) throughout this

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article, is construed as the modulus of the corresponding vector, taken with the required sign). Ultimately, the author derives the equation of motion

$$\dot{\mathbf{M}} = -\gamma\,[\mathbf{M}, \mathbf{H}_0 - \alpha\dot{\mathbf{M}} + \beta\ddot{\mathbf{M}} - \eta\dddot{\mathbf{M}}]$$

where $\mathbf{H}_0$ is the sum of the external field and all the fields dependent on the orientation of $\mathbf{M}$ in the body: the anisotropy field, the demagnetizing fields, and the fields conditioned by the body's deformation. This equation is then solved for the case of the pulsed magnetic polarity reversal in thin ferromagnetic films and thin ferrite plates, both with uniaxial anisotropy. For example, in the problem considered, the inertial field $\mathbf{H}_{in}$, conditioned by the energy of the demagnetizing field H_z in the film, amounts to $\dot{\varphi}/4\pi\gamma^2 M_0$ and when $\ddot{\varphi} = 10^3$ $\mathbf{H}_{in}$ reaches a magnitude of the order of an oersted, comparable with that of the external control field $\mathbf{H}_e$. Eq. (14) in the general case can be solved only by numerical methods. In this particular case it can be simplified so as to obtain, to some approximation, a general solution. The process of the pulsed and cyclic reversals of magnetization in thin ferromagnetic films and thin ferrite plates is examined on this basis, on employing a

L 56079-65

ACCESSION NR: AP5013806

spherical coordinate system such that the film or plate lies in the plane of the equator (x, y). Some information on dynamic properties can be obtained by reversing the magnetic polarity of the film or plate by means of a rotating field H_{ex}. The investigation of the specific form of the dissipation and inertia terms makes it possible to analyze more thoroughly the dynamics of the magnetic moment. Orig. art. has: 33 formulas.

ASSOCIATION: Institut fiziki SO AN SSSR (Institute of Physics, SO AN SSSR)

SUBMITTED: 22Apr64 ENCL: 00 SUB CODE: EM

NO REF SOV: 008 OTHER: 003

Card 3/3

RODICHEV, A.M.; RUMANOV, E.N.

Theory of the magnetic reversal of thin ferromagnetic films in strong fields. Izv. AN SSSR. Ser. fiz. 26 no.2:296-299 F '62. (MIRA 15:2)

(Ferromagnetism)
(Magnetic fields)

S/058/61/000/012/064/083
A058/A101

AUTHORS: Rodichev, A.M., Ignatchenko, V.A., Salanskiy, N.M.

TITLE: Evaluating the Barkhausen jump

PERIODICAL: Referativnyy zhurnal. Fizika, no. 12, 1961, 385, abstract 12E700 (V sb. "Magnitn. struktura ferromagnetikov", Novosibirsk, Sib. otd. AN SSSR, 1960, 113 - 121)

TEXT: The Barkhausen jump is regarded as a variable magnetic dipole with magnetic moment m=m(t). The emf induced by the dipole field in single-layer and multilayer measuring coils is determined. It is assumed that field H is parallel or antiparallel to domain magnetization. It is shown that incident to evaluation of the Barkhausen jump, length l of the measuring coil has a great effect on measurement results; for the error not to exceed 10%, the condition $l \gg 40D$ must be observed (D being the mean diameter of the measuring coil). Maximum accuracy can be achieved if l exceeds specimen length by 2D. It is noted that experimental setups for measuring the Barkhausen jump that do not contain special integrating elements or that have a measuring coil for a pickup can only be graduated in

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Evaluating the Barkhausen jump

S/058/61/000/012/064/083
A058/A101

terms of dm/dt. On the basis of an experiment simulating the Barkhausen jump, it was found that the formulae of the present work can be utilized for specimens with $d \leqslant 0.6$ mm (d is specimen diameter).

L. Vinokurova

[Abstracter's note: Complete translation]

Card 2/2

S/058/61/000/012/066/083
A058/A101

AUTHORS: Ignatchenko, V.A., Rodichev, A.M.

TITLE: Concerning the distribution in magnitude of Barkhausen jumps

PERIODICAL: Referativnyy zhurnal. Fizika, no. 12, 1961, 385, abstract 12E702 (V sb. "Magnitn. struktura ferromagnetikov", Novosibirsk, Sib. otd. AN SSSR, 1960, 123 - 127)

TEXT: The distribution in magnitude of the Barkhausen jumps is associated with how ordered in structure the specimen is. It is pointed out that experimental setups having only one measuring coil for a pickup can only measure one component of the rate of change dm^o/dt of the magnetic moment incident to jumps, for instance in the case of field H parallel to the Z-axis of the coil dm^o_z/dt. If, however, the texture degree W is known, then the V_o distribution (V_o being the volume remagnetized as a result of Barkhausen jumps) can be determined on the basis of the measured distribution of m^o_z. A calculation method is provided. In the case of a single crystal (the V_o distribution being known) the degree of ordering of domain structure (W) is determined from the measured m^o_z distribution. Calcula-

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Concerning the distribution ...

S/058/61/000/012/066/083
A058/A101

tion results were qualitatively borne out by experimental verification on Fe-Si single crystals and polycrystals.

L. Vinokurova

[Abstracter's note: Complete translation]

Card 2/2

S/058/61/000/012/068/083
A058/A101

AUTHOR: Rodichev, A.M.

TITLE: Variation of the Barkhausen effect with the rate of change of the magnetic field

PERIODICAL: Referativnyy zhurnal. Fizika, no. 12, 1961, 386, abstract 12E704 (V sb. "Magnitn. struktura ferromagnetikov", Novosibirsk, Sib. otd. AN SSSR, 1960, 135 - 142)

TEXT: Variation in the number of Barkhausen jumps and in their amplitude as a function of the rate of magnetic field change dH/dt was investigated in Fe and Ni specimens with d=0.2 mm and l=50÷60 mm. Integral and differential curves for the distribution in amplitude of Barkhausen jumps were plotted for different values of dH/dt. The mean value A_{me} and the most probable value A_{mp} of the amplitude were calculated. It was found that the total number of Barkhausen jumps decreases with increasing dH/dt while their amplitude increases. A_{me} and A_{mp} are directly proportional to dH/dt. With increasing dH/dt the region of most intense Barkhausen jumps is shifted to the side of higher H. The effect of the demagnetiz-

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Variation of the Barkhausen effect ...

ing factor on the Barkhausen jump is examined. It is noted that investigations of the Barkhausen effect should be carried out taking into account variations in the rate of rise of the internal field.

L. Vinokurova

[Abstracter's note: Complete translation]

S/058/61/000/012/067/083
A058/A101

AUTHORS: Savchenko, M.K., Rodichev, A.M.

TITLE: Concerning simultaneous observation of domain structure and Barkhausen effect

PERIODICAL: Referativnyy zhurnal, Fizika, no. 12, 1961, 385-386, abstract 12E703 (V sb. "Magnitn. struktura ferromagnetikov", Novosibirsk, Sib. otd. AN SSSR, 1960, 147 - 150)

TEXT: The distribution of Barkhausen jumps incident to tension (in three principal directions) was measured in single-crystal and polycrystalline specimens of cold-rolled steel (3% Si). At the same time, domain structure was studied by means of powder figures. It was found that Barkhausen jumps appear not only as a result of irreversible boundary shifts due to the presence of nonmagnetic enclaves and stresses, but also as a result of the rebuilding of domain structure that takes place incident to application of stresses and during remagnetization.

L. Vinokurova

[Abstracter's note: Complete translation]

Card 1/1

33685
S/058/61/000/012/069/083
A058/A101

24,2200 (1068, 1147, 1164)

AUTHORS: Rodichev, A.M., Savchenko, M.K.

TITLE: Mechanical Barkhausen effect in transformer-steel single crystals

PERIODICAL: Referativnyy zhurnal. Fizika, no. 12, 1961, 386, abstract 12E705 (V sb. "Magnitn. struktura ferromagnetikov", Novosibirsk, Sib. otd. AN SSSR, 1960, 151 - 153)

TEXT: The dependence of the mechanical Barkhausen effect on the rate of change of the load $d\sigma/dt$ incident to tension was studied in [100] axis-cut single crystals of transformer steel. It was found that the number of Barkhausen jumps depends on how many preliminary tension cycles the specimen has undergone, so only the results of the first cycle after annealing were fixed (beginning with 0.3 kg/mm^2). There were obtained curves for the integral and differential distributions in amplitude of the number of jumps for different $d\sigma/dt$. The mean and the most probable amplitudes of the jumps were computed. It was established that with increasing $d\sigma/dt$ the number of jumps decreases while their amplitude increases. The obtained distribution of jumps in amplitude incident to tension is analogous

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33685
S/058/61/000/012/069/083
A058/A101

Mechanical Barkhausen effect ...

to that of the Barkhausen jump incident to magnetization, and the effect accompanying a change in $d\sigma/dt$ is analogous to that accompanying a change in dH/dt.

L. Vinokurova

[Abstracter's note: Complete translation]

34177
S/048/62/026/002/026/032
B117/B138

24.2200 (1147, 1164, 1482)

AUTHORS: Rodichev, A. M., and Rumanov, E. N.

TITLE: Theory of magnetic reversal of thin ferromagnetic films in strong fields

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 2, 1962, 296-299

TEXT: This paper was presented at a conference on magnetism and antiferromagnetism. The limits of applicability of the uniform rotation pattern were analyzed on the basis of available experimental data. Simplified equations were suggested to describe magnetic reversal by uniform rotation:

$$\begin{cases} -(1/g)\dot{\eta} = A + \alpha\eta n_z M, \\ (1/g)\dot{\varphi} = -\dot{\eta} n_z M + \alpha A \end{cases} \qquad (4)$$

$A = H_x \sin\varphi - \beta M \sin\varphi \cdot \cos\varphi + H_y \cos\varphi$; $\eta = \pi/2 - \Theta$ are variables; α is a dimensionless relaxation constant; n_z is the demagnetizing factor in direction z; H_x and H_y are field components; β is the anisotropy constant.

Card 1/3

Theory of magnetic reversal of...

With aperiodic motion where φ is always $\gg\eta$, (4) can be written in the form

$$\dot{\varphi} = (g/\alpha)(\dot{H}_x \sin\varphi - \beta M \sin\varphi\cdot\cos\varphi + H_y \cos\varphi) \quad (5)$$

The magnetic reversal time τ can be calculated from

$$(1/\tau) = G(H_x - \beta M), \quad (6)$$

$$G = (g/2\alpha)\cdot\left[1/\ln \cot(\varphi_o/2)\right]$$

The formation and growth of domains of reverse magnetization observed (Ref. 8, see below) in fields of 1-3 oe mean that magnetic reversal takes place at low pulsed magnetic fields. In a two-dimensional system (film) magnetic reversal may be regarded as a phase transition from the metastable (magnetization against the field direction) to the equilibrium state (magnetization in the direction of field). The oppositely magnetized domains are nuclei of the stable phase. As the number of these nuclei increases an H_y-dependent correlation is observed. For the formation of nuclei in points y_1 and y_2 (the nuclei lie along axis x) this dependence can be expressed by $\Delta s(y_1)\,\Delta s(y_2) \sim \Delta s^2 \exp(2M^2/kT\cdot\Delta s^2\varphi^2/r^3)$ (9). Δs is the surface of the nucleus; $\varphi = H_y(H_x + \beta M)$; $r = |y_1 - y_2|$. Of

Card 2/3

L 22250-66 EWT(1) IJP(c)

ACC NR: AP6010983 SOURCE CODE: UR/0056/66/050/003/0626/0629

AUTHOR: Rodichev, A. M. (Deceased); Khlebopros, Ye. A.; Khlebopros, R. G.

57
B

ORG: Physics Institute of the Siberian Department of the Academy of Sciences, SSSR (Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR)

TITLE: Effects due to inertia of the magnetic moment

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 50, no. 3, 1966, 626-629

TOPIC TAGS: magnetic moment, magnetic field, ferromagnetism, magnetic susceptibility, electromagnetic wave

ABSTRACT: It is shown that the effect of the inertia of the magnetic moment on the interaction of an electromagnetic wave with a plate magnetized perpendicular to its plane leads to a number of new effects. Owing to the presence of an inertial field, resonance effects can also be observed when the direction of circular polarization of the electromagnetic wave (which is propagated perpendicular to the plate) is opposite to the direction of free magnetization precession. This may result in vanishing of the real part of the magnetic suscpetibility for waves of both polarizations, to a two-fold (or three-fold change in the direction of rotation of the polarization plane and to other effects arising during transmission or reflection of the electromagnetic wave. [CS]

SUB CODE: 20/ SUBM DATE: 22Jul65/ ORIG REF: 007/ OTH REF: 002/

Card 1/1 nst

S/0126/64/017/001/0148/0150

ACCESSION NR: AP4013104

AUTHORS: Salanskiy, N. M.; Rodichev, A. M.

TITLE: Duration of Barkhausen pulse in ferromagnets

SOURCE: Fizika metallov i metalloved., v. 17, no. 1, 1964, 148-150

TOPIC TAGS: Barkhausen pulse, ferromagnet, reversible permeability, nickel, chromium, magnetic moment, signal noise ratio, permalloy, NGPK generator

ABSTRACT: Measurements were taken on nickel specimens 0.99 mm in diameter, and on Ni with 1% Cr specimens of varying radii (0.06, 0.12, 0.21 and 0.31 mm) to study the variation in the duration of the Barkhausen pulse with reversible permeability and changing radius. The duration of the pulse was measured by a method which was an improvement on the one given by A. M. Rodichev, N. M. Salanskiy, and V. I. Sinegubov (Izv. SO AN SSSR 1960, No. 3, 123). The duration had a threshold of 0.5 microseconds, and the time constant of the apparatus was below 0.3 microseconds. An NGPK generator was used to measure the intensity of the magnetic field. The reversible permeability was measured by the superposition of an extremely small alternating field of amplitude 10-2 - 10-3oerstds. Experiments were also performed on permalloy tapes (80% Ni, 17% Fe, 3% Mo) 1700 A thick to study the behavior of

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ACCESSION NR: AP4013104

the duration of the pulse at magnetic reversal. The dependence of the duration on the radius is shown in Fig. 1 of the Enclosure. The results shown in Fig. 1 agree qualitatively with those of the theoretical formula given by K. M. Polivanov, A. M. Rodichev and V. A. Ignatchenko (FMM, 1960, 9, 778)

$$\varepsilon(t) = 2\mu_0 m_0 N_0 \sum_{n=1}^{\infty} \frac{\lambda_n I_0\left(\lambda_n \frac{r}{r_0}\right)}{I_1(\lambda_n) r_0^2 \mu\mu_0\sigma} \exp\left(-\frac{\lambda_n^2 t}{r_0^2 \mu\mu_0\sigma}\right),$$

where μ_0 is $4\pi \times 10^{-7}$, m_0 - the magnitude of the variation of the magnetic moment, N_0 - the number of turns of winding per unit length, λ_n the n-th root of the Bessel function I_0, r_0 - the radius of the specimen, μ - the reversible permeability, and σ - the conductivity. Orig. art. has: 1 formula and 3 figures.

ASSOCIATION: Institut fiziki, SO AN SSSR (Institute of Physics, SO AN SSSR)

SUBMITTED: 06Aug62 ENCL: 01

SUB CODE: MM NO REF SOV: 004 OTHER: 000

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ENCLOSURE: 01

ACCESSION NR: AP4013104

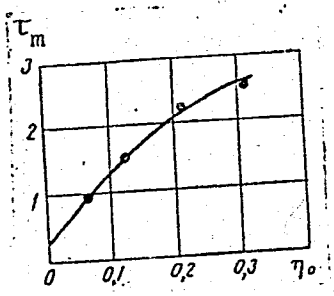

Fig. 1. Dependence of the mean duration of the Barkhausen pulse on the radius of the specimen r_0.

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RODICHEV, A.M., IGNATCHENKO, V.A.

Dynamics of the Barkhausen jump. Fiz. met. i metalloved. 9 no.6: 903-908 Je '60. (MIRA 13:7)

1. Institut fiziki AN SSSR.
(Ferromagnetism) (Crystal lattices)

SALANSKIY, N.M.; RODICHEV, A.M.; SAVCHENKO, M.K.

Barkhausen effect in thin films of molybdenum and permalloy. Izv.Sib.otd.AN SSSR no.4:110-113 '61. (MIRA 14:6)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR, Krasnoyarsk.
(Barkhausen effect)
(Permalloys)
(Molybdenum)

SALANSKIY, N.M.; RODICHEV, A.M.; BURAVIKHIN, V.A.

Reversible and irreversible processes in the remagnetization of single crystals of silicon iron. Fiz. met. i metalloved. 11 no.6:843-850 Je '61. (MIRA 14:6)

1. Institut fiziki metallov Sibirskogo otdeleniya AN SSSR.
(Metal crystals--Magnetic properties)

SALANSKIY, N.M.; RODICHEV, A.M.; SAVCHENKO, M.K.

Barkhausen effect in thin molybdenum-permalloy films. Izv.AN SSSR. Ser.fiz. 25 no.5:602-605 My '61. (MIRA 14:5)

1. Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR.
(Molybdenum-nickel-iron alloys—Magnetic properties)
(Metallic films—Magnetic properties)

RODICHEV, A.M.

Theory of the magnetic reversal of thin films in strong fields. (MIRA 14:5)
Izv.AN SSSR.Ser.fiz. 25 no.5:614-618 My '61.
(Metallic films--Magnetic properties)

SALANSKIY, N.M.; RODICHEV, A.M.

Duration of Barkhausen pulses in ferromagnetic substances. Izv. AN SSSR. Ser. fiz. 28 no.1:161-163 Ja '64. (MIRA 17:1)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

SALANSKIY, N.M.; LOGUTKO, A.L.; RODICHEV, A.M.

Curve of equilibrium states obtained in the magnetization of a ferrosilicon crystal. Izv. AN SSSR. Ser. fiz. 28 no.1:169-171 Ja '64. (MIRA 17:1)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

RODICHEV, A.M.

Effect of magnetization inhomogeneity on the process of pulsed magnetic polarity reversal. Fiz. met. i metalloved. 17 no.1:146-148 Ja '64. (MIRA 17:2)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

KIRENSKIY, L.V.; SALANSKIY, N.M.; RODICHEV, A.M.

Reversible and irreversible processes in the magnetic reversal of an elastically stretched-out iron-nickel polycrystal (Barkhausen effect appearing as the hysteresis loop approaches a rectangular shape). Izv. AN SSSR. Ser. fiz. 28 no.1:164-168 Ja '64. (MIRA 17:1)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

SALANSKIY, N.M.; RODICHEV, A.M.

Duration of Barkhausen pulses in ferromagnetic materials. Fiz. met. i metalloved. 17 no.1:148-150 Ja '64. (MIRA 17:2)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.

ACCESSION NR: AP4013103 S/0126/64/017/001/0146/0148

AUTHOR: Rodichev, A. M.

TITLE: Influence of magnetization inhomogeneity on the process of pulsed magnetic reversal

SOURCE: Fizika metallov i metalloved., v. 17, no. 1, 1964, 146-148

TOPIC TAGS: magnetization inhomogeneity, pulsed magnetic reversal, ferromagnetic film, magnetic moment

ABSTRACT: It has been found experimentally that a small constant magnetic field superimposed perpendicularly to the pulsed magnetic reversing field H_e significantly reduces the time of magnetic reversal in a thin ferromagnetic film. The effect of spatial inhomogeneity of the magnetic moment orientation in the initial (magnetized) state is considered, since the phenomenon is unexplainable by the model of a uniformly rotating magnetic moment of the whole film. The film is assumed to be composed of randomly distributed regions of only two types: one with the magnetic moment initially deflected at an angle ϕ_0 to the right of the z axis; the other, at an angle ϕ_0 to the left of the z axis (H_e is taken

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ACCESSION NR: AP4013103

parallel to the z axis). The rotational velocity of the magnetic moment M is given by:

$$\frac{d\varphi}{dt} = \frac{1}{a}(H_z \sin\varphi - n_1 \cos\varphi \sin\varphi - 2H_s \cos\varphi \sin\varphi).$$

where γ is the gyromagnetic ratio, a is the attenuation constant, the anisotropy field

$$H_a = n_1 \cos\varphi = \frac{2k}{M}\cos\varphi$$

is parallel to the z axis (k is the constant of anisotropy) and H_s is the supplementary field created in the film by the magnetic moments of one type of region. Orig. art. has: 8 equations and 2 diagrams.

ASSOCIATION: Institut fiziki SO AN SSSR (Institute of Physics SO AN SSSR)

SUBMITTED: 18Mar63 DATE ACQ: 26Feb64 ENCL: 00

SUB CODE: GP NO REF SOV: 002 OTHER: 002

Card 2/2

S/126/60/009/05/019/025
E032/E314

AUTHORS: Polivanov, K.M., Rodichev, A.M. and Ignatchenko, V.A.

TITLE: The Effect of the Parameters of Ferromagnetics on the Measurements of the Barkhausen Effect

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 5, pp 778 - 789 (USSR)

ABSTRACT: The Barkhausen effect is usually studied by measuring the emf induced in a coil surrounding the ferromagnetic specimen. The emf pulses induced in this coil by discontinuous changes in the magnetization are the only source of information about this phenomenon. The time interval between successive pulses can be made quite large by a suitable choice of the linear dimensions of the specimen and the rate of change in the magnetic field H . Under such conditions each emf pulse corresponds to a single discontinuity. The present paper is concerned with the determination of the relationship between the pulse parameters and the volume of the region in the ferromagnetic within which the discontinuous change in the magnetization takes place, the increase in the magnetization, the change in the magnetic moment, the duration and the rate

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S/126/60/009/05/019/025
E032/E314

The Effect of the Parameters of Ferromagnetics on the Measurements of the Barkhausen Effect

of the process, etc. It is shown that the only physical characteristic which can be found directly from the observed induced emf is the change in the dipole moment m_o which is proportional to the time integral of the induced emf. It follows that it is desirable to include an electronic integrator in the usual apparatus employed to measure the Barkhausen effect. A formula is obtained (Eq 21) which expresses the emf induced in the measuring coil as a function of the change in the magnetic dipole moment of a region in a ferromagnetic cylinder at an arbitrary distance from its axis. The formula is similar to that obtained by Tebble et al (Ref 3) but its derivation is more rigorous. The theoretical calculations are compared with published experimental results. There are 12 figures and 11 references, 8 of which are Soviet, 1 German and 2 English.

ASSOCIATION: Institut fiziki AN SSSR (Institute of Physics of the Ac.Sc., USSR)

SUBMITTED: December 15, 1959

Card 2/2

22344

S/200/61/000/004/004/005
D228/D305

18.1112

AUTHORS: Salanskiy, N. M., Rodichev, A. M., and Savchenko, M. K.

TITLE: The Barkhausen effect in thin molybdenum-permalloy plates

PERIODICAL: Akademiya nauk SSSR. Sibirskoye otdeleniye. Izvestiya, no. 4, 1961, 110-113

TEXT: This is a report on a series of experiments investigating the influence of many factors on the "Barkhausen discontinuities" or so called "Barkhausen steps" in thin molybdenum-permalloy plates, namely the dependence of the number of "steps" on the thickness of strip and rate of change of the magnetic field and the dependence of mean magnetic moments of steps on the thickness of the strip. The distribution of steps according to magnetic moments was also examined as well as the strength of the magnetic field, influence of direction of reverse magnetization in respect to the anisotropic axis of strips and the influence of annealing in the presence or absence of a magnetic field. After describing how the Barkhausen

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The Barkhausen effect...

effect was measured, the authors point out that the distribution of Barkhausen "discontinuities" or so called Barkhausen "steps" according to the moments is analogous with distribution in ferromagnetics not only as regards the character but also as the absolute values of the moments. If it is assumed that the area of the step envelops the whole thickness of the strip, for the strip of thickness 600 Å "steps" from 0.6 to $9.0.10^{-6}$ cgsm units occupy respectively an area of 0.01 - 0.15 mm^2 on the surface of the strip. Distribution of steps accordingly to magnetic moments in all strips is expressed by

$$N = N_o e^{-am^{\frac{1}{2}}} \qquad (1)$$

where N_o and a are constant for a given strip. The mean moment of steps depends on the thickness of the strip and in the range of thicknesses examined, it increases linearly with an increase of thickness, as if the area dimensions reversely magnetized by the step in the plane of the strip did not change and only the dimension along the thickness of the strip increases. Dependence of the mean moment of steps on the presence or absence of a magnetic

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field during annealing was not observed. The dependence of the number of steps on the thickness of strip is illustrated. The rate of increase of the number of steps with an increase in thickness is greater for strips annealed in the field than for strips annealed without a field. Extrapolation of these curves gives the disappearance of the Barkhausen effect for a thickness of 350 Å. Taking into consideration that the dimensions of steps decrease with the decreasing thickness of the strip and that some of them may be below the sensitivity of the equipment, a thickness of 350 Å should be considered as greater than the criterion of one domain. The distribution of steps according to the strength of magnetic field "H" is also given in graphic form. In contrast to ferromagnetics, for which steps appear in negative fields (when the field changes from negative to positive) steps in strips appear in positive fields and the range of fields where steps appear is smaller for strips. In conclusion the possibility of employing certain characteristics of the Barkhausen effect as a criterion of the rate of impulse reverse magnetization of strips is suggested. One step reversely magnetizes a strip at very high speed. Non-syn-

The Barkhausen effect...

S/200/61/000/004/004/005
D228/D305

chronism of reverse magnetization of different parts of a strip has a retarding effect. For a large number of steps, it is desired that these have critical fields as close as possible to each other so that the distribution of steps according to the field could be represented by a tight curve. The authors feel that the duration of steps appears dependent on the characteristics of impulse reverse magnetization and further experiments in this direction could be useful. There are 5 figures and 3 non-Soviet-bloc references. The references to the English-language publications read as follows: R. S. Tebble, I. C. Skidmore and W. D. Corner, Proc. Phys. Soc. A63, 739 (1950), N. C. Ford and E. W. Pugh. Journ. Appl. Phys. 30, 4, Suppl. 270 (1959).

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya AN SSSR Krasnoyarsk (Institute of Physics, Siberian Division AS USSR, Krasnoyarsk)

SUBMITTED: August 12, 1960

Card 4/4

KIRENSKIY, L.V.; SALANSKIY, N.M.; RODICHEV, A.M.

The Barkhausen effect at the approach of the hysteresis loop to a rectangle. Fiz. met. i metalloved. 16 no.4:630-632 O '63. (MIRA 16:12)

1. Institut fiziki AN SSSR.

S/126/60/009/06/015/025
E073/E335

AUTHORS: Rodichev, A.M. and Ignatchenko, V.A.

TITLE: Dynamics of the Barkhausen Jump

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 6, pp 903 - 908 (USSR)

ABSTRACT: The authors investigated the character of the movement of the domain boundary during a Barkhausen jump. The Barkhausen jump is attributed to the following mechanism: in the case of a slow increase of the magnetic field H the boundary between domains displaces in such a way that at each instant of time the conditions of the sum of all magnetic energies having a minimum are fulfilled. If the boundary hits a barrier, it may impede its movement. In this paper a solution is obtained of the equation of motion which has been written taking into consideration the basic forces acting on the boundary and formulae are derived which establish the dependence of the duration and speed of the process on various characteristics of the ferromagnetic. In another paper (Ref 8), the authors report on the measurement of the distribution of Barkhausen jumps as a function of pulse durations in

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Dynamics of the Barkhausen Jump

S/126/60/009/06/015/025
E073/E335

nickel specimens for pulses of durations between 2 and 30 μs. The analysis of the results of this experiment published in earlier work (Ref 2) leads to the conclusion that the real durations of the jumps did not exceed 1 μs. Evaluation by means of Eq (14) of this paper for an equal specimen yields time values which are not contradictory to these conclusions.
There are 3 figures and 8 references, 3 of which are English, 2 French, 1 German and 2 Soviet.

ASSOCIATION: Institut fiziki AN SSSR (Institute of Physics of the Ac.Sc. USSR)

SUBMITTED: December 15, 1959

Card 2/2

√B

KIM, P.D.; RODIONOV, G.M.

Determining the parameter of viscous damping in thin films. Fiz. met. i metalloved. 20 no.3:467-469 S '65. (MIRA 18:11)

1. Krasnoyarskiy politekhnicheskiy institut.

RODICHEV, G.M.; PRESNETSOV, V.N.; KIM, P.D.

Irreversible processes during the quasistatic magnetic polarity reversal in thin films. Fiz. met. i metalloved. 20 no.4:504-507 O '65. (MIRA 18:11)

1. Krasnoyarskiy politekhnicheskiy institut.

L 26631-66 EWT(m)/T/EWP(t) IJP(c) JD/HW/JG

ACC NR: AP5025337 SOURCE CODE: UR/0126/65/020/003/0467/0469

AUTHOR: Kim, P. D.; Rodichev, G. M.

ORG: Krasnoyarsk Polytechnic Institute (Krasnoyarskiy politekhnicheskiy institut)

TITLE: Determination of the parameter of tensile damping in thin films

SOURCE: Fizika metallov i metallovedeniye, v. 20, no. 3, 1965, 467-469

TOPIC TAGS: magnetic induction, iron alloy, nickel alloy, molybdenum alloy, metal film, magnetic thin film, single crystal, iron oxide, magnetization

ABSTRACT: The authors have shown that the parameter of tensile damping β can be determined by means of eddy current during boundary motion and can be experimentally calculated. The determination of parameter (β) in thin films will help to explain the mechanism of losses associated with boundary motion. Films obtained by the vacuum volatilization of the Fe-Ni-Mo alloy on glass slides were used. Curves are shown on the function of velocity of the distribution of the inverse magnetization of the field area of two films from Fe-Ni-Mo alloy. From these curves which satisfy the equation $v = A(H-H_0)$ the value of a coefficient was

Card 1/2 UDC: 538.114:539.216.2

L 20031-66

ACC NR: AP5025337

found to be $A_1=(9\pm3)10^4$ cm/sec.e and $A_2=(2.4\pm0.8)\ 10^4$ cm/sec.e. Using the coefficient A, the parameter of tensile damping β can be calculated if the exact form of the border motion is known. The calculated parameter of a film with a thickness of 2000Å was found to be $\beta_1=0.12\pm0.04$g/cm^2.sec and for a film with a thickness of 1000 Å was $\beta=0.23\pm0.08$g/cm^2.sec. The values found are close to the values β obtained from the monocrystals of Fe_3O_4. Orig. art. has: 3 fig.

SUB CODE: 11,20/SUBM DATE: 25Nov64/ ORIG REF: 001/ OTH REF: 003

Card 2/2

EWT(l)/EWP(m)/EWP(t)/ETI IJP(c) JD

ACC NR: AP6030134 SOURCE CODE: UR/0048/66/030/006/1062/1064

AUTHOR: Rodichev, G.M.; Lyakhovskiy, N.P.; Rodichev, G.M.

ORG: Krasnoyarsk Polytechnic Institute (Krasnoyarskiy politekhnicheskiy institut)

TITLE: Investigation of magnetic moment rotation in Permalloy films [Report, All-Union Conference on the Physics of Ferro- and Antiferromagnetism held 2-7 July 1965 in Sverdlovsk]

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 30, no. 6, 1966, 1062-1064

TOPIC TAGS: ferromagnetic film, permalloy, pulsed magnetic field, magnetic coercive force, magnetic anisotropy, MAGNETIC MOMENT

ABSTRACT: The authors have investigated pulsed switching in Permalloy films of the magnetization from the easy direction in the plane of the film to the hard direction, also in the plane of the film. Two types of film were investigated: in the type 1 films quasistatic switching from the easy to the hard direction was realized without domain wall displacement, and without formation of domains at all when the magnetization was saturated; in the type 2 films domain wall displacement occurred during quasistatic switching but accounted for less than 10% of the total magnetization change. In all the films the coercive force was nearly equal to, and in some of them it was greater than, the anisotropy field. The different treatments required to produce type 1 and type 2 films are not described. In the present experiments switching

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L 08767-67
ACC NR: AP6029134

was accomplished with pulses having rise times of less than 2 nanosec. The switching times in the type 1 films were too short to measure, but rough estimates gave values for the damping constant α in the equation of T.L.Gilbert (Phys. Rev., 100, 1243 (1965)) that were of the order of magnitude of those obtained by the resonance method. In the type 2 films the switching time increased with increasing switching field, reached a maximum (of about 100 nanosec in at least one 3300 Å thick film) at a switching field approximately equal to the anisotropy field, and decreased with further increase of the switching field. It is suggested that the increase in switching time with increasing switching field may be due to inertial properties of the magnetization and to nonuniformity of the magnetization rotation occasioned by the large angular dispersion of the local easy axes. Orig. art. has: 2 figures.

SUB CODE: 20 SUBM DATE: 00 ORIG. REF: 002 OTH REF: 001

Card 2/2 bc

L 8087-66 EWT(l)/EWT(m)/EWP(i)/T/EWP(t)/EWP(b) IJP(c) JD/GG

ACC NR: AP5027132 SOURCE CODE: UR/0126/65/020/004/0504/0507

AUTHOR: Rodichev, G. M.; Presnetsov, V. N.; Kim, P. D.

ORG: Krasnoyarsk Polytechnic Institute (Krasnoyarskiy politekhnicheskiy institut)

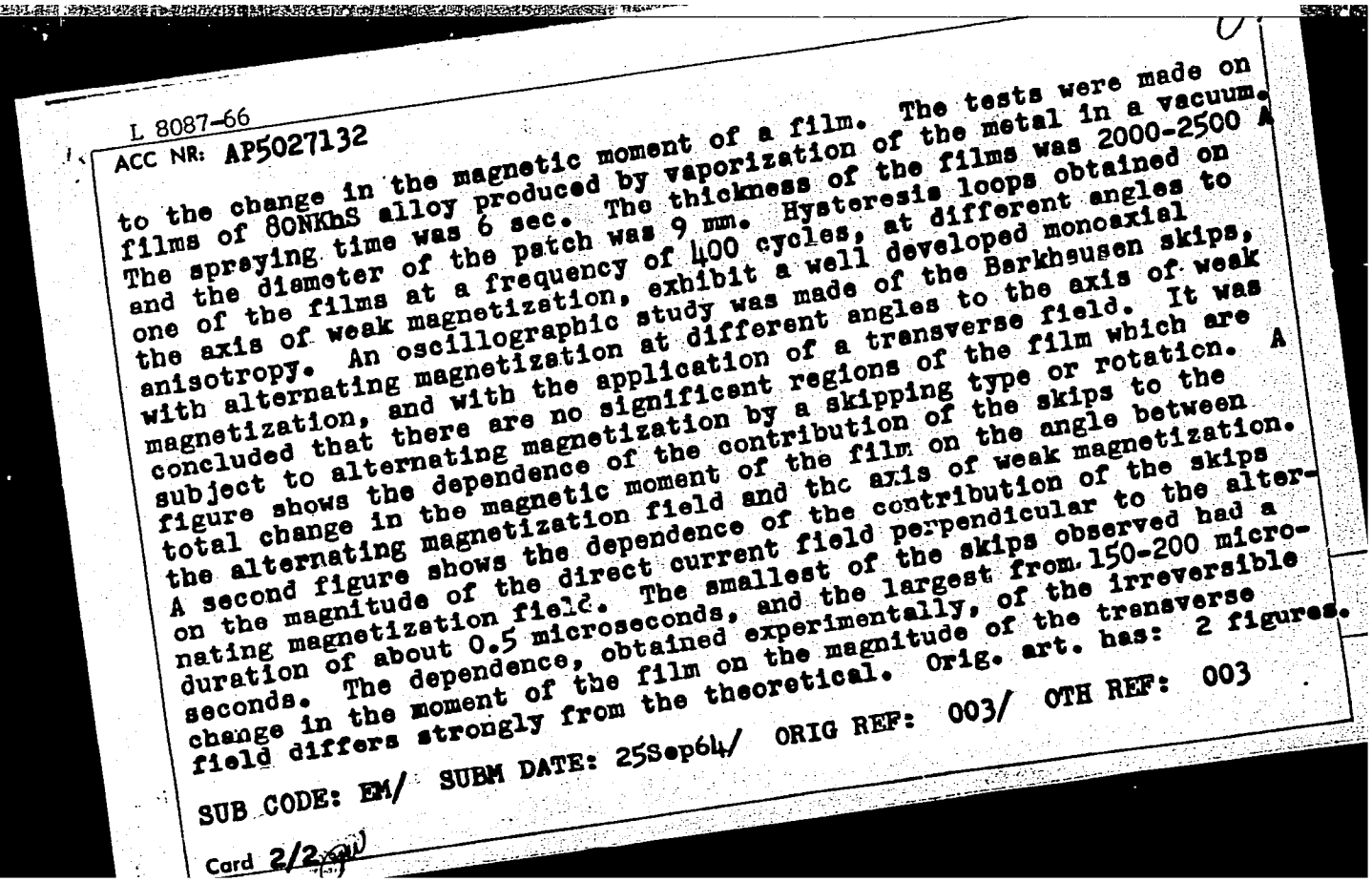
TITLE: Irreversible processes in the quasistatic alternating magnetization of thin films

SOURCE: Fizika metallov i metallovedeniye, v. 20, no. 4, 1965, 504-507

TOPIC TAGS: irreversible process, magnetization, magnetic thin film

ABSTRACT: Although the hysteresis loops obtained experimentally in the quasistatic alternating magnetization of thin films in general recall theoretically obtained hysteresis loops, there is a main difference between them. In a theoretical hysteresis loop, the process of alternating magnetization appears to be a homogeneous rotation of the magnetization (reversible and irreversible). The process of quasistatic alternating magnetization is not a homogeneous rotation, and the appearand and growth of domains plays a large role in it. By a study of the Barkhausen effect and observation of the domain structure, the present article attempts to analyze the processes of the shift in boundaries and the rotation of the magnetization and to evaluate their contribution

Card 1/2 UDC: 539.216.2:538.24



L 8087-66
ACC NR: AP5027132

to the change in the magnetic moment of a film. The tests were made on films of 80NKhS alloy produced by vaporization of the metal in a vacuum. The spraying time was 6 sec. The thickness of the films was 2000-2500 A and the diameter of the patch was 9 mm. Hysteresis loops obtained on one of the films at a frequency of 400 cycles, at different angles to the axis of weak magnetization, exhibit a well developed monoaxial anisotropy. An oscillographic study was made of the Barkhausen skips, with alternating magnetization at different angles to the axis of weak magnetization, and with the application of a transverse field. It was concluded that there are no significant regions of the film which are subject to alternating magnetization by a skipping type or rotation. A figure shows the dependence of the contribution of the skips to the total change in the magnetic moment of the film on the angle between the alternating magnetization field and the axis of weak magnetization. A second figure shows the dependence of the direct current field perpendicular to the alternating magnetization field on the contribution of the skips observed had a duration of about 0.5 microseconds, and the largest from 150-200 microseconds. The dependence, obtained experimentally, of the irreversible change in the moment of the film on the magnitude of the transverse field differs strongly from the theoretical. Orig. art. has: 2 figures.

SUB CODE: EM/ SUBM DATE: 25Sep64/ ORIG REF: 003/ OTH REF: 003

Card 2/2

34180

S/048/62/026/002/029/032
B117/B138

24,2200 (1147,1164,1482)

AUTHORS: Kim, P. D., and Rodichev, G. M.

TITLE: Large Barkhausen jumps in thin ferromagnetic films

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 2, 1962, 306 - 310

TEXT: This paper was presented at a conference on magnetism and antiferromagnetism. The dynamics of the domain boundaries was studied by investigating the large Barkhausen jumps in thin (1500 to 2000 Å) iron and Fe-Ni-Mo vacuum condensed films, with a magnetic field directed along the base. Some of these films underwent complete magnetic reversal in one Barkhausen jump. The measurements were made with a monolayer measuring coil no. 1 (length 10 mm, winding diameter 1 mm, 328 turns) and with two series-connected coils no. 2 (length 0.2 mm, 100 turns each). The authors were able to make experiments similar to those of Sixtus and Tonks (Ref. 1, see below) and to study the field dependence of the rate of propagation v of the oppositely magnetized domain. For magnetic reversal in fields lower than H_c

Card 1/3

artificial nuclei must be created. This was done by means of an additional coil. The v value determined was not in agreement with the rate of boundary migration $\dot{L}$, as the boundary is not at an angle of 90° to the direction of displacement. To determine $\dot{L}$ and, consequently, also the parameter of elastic damping β, which determines the losses due to boundary migration, the exact shape of the boundary must be known. The proportionality of v to $(H - H_0)$ found is equivalent to the proportionality between $\dot{L}$ and $(H - H_0)$ as the shape of the boundaries did not change during the movement. Both v and H_0 depend on the shape of the boundary, itself dependent on the method by which the nucleus was created. The dependence of H_0 on imperfections and material defects was studied in Fe-Ni-Mo films. The study of large Barkhausen jumps may be of great practical importance since the hysteresis loops of the substances subject to magnetic reversal in one jump, are highly orthogonal. There are 5 figures and 4 non-Soviet references. The four references to the English-language publications read as follows: Sixtus K. J., Tonks, Phys. Rev., 37, 930 (1931); 42, 419 (1932); 48, 425 (1935). Williams H. J. et al. Phys. Rev., 80, 1090 (1950). Galt

34180

Large Barkhausen jumps ... S/048/62/026/002/029/032
B117/B138

J. K., Bell System Techn. J., 33, 1023 (1954). Kittel C., Galt J., Solid State Physics, 3, p. 437. New York, 1956.

ASSOCIATION: Krasnoyarskiy politekhnicheskiy institut (Krasnoyarsk Polytechnic Institute)

Card 3/3

S/126/60/009/06/015/025
E073/E335

AUTHORS: Rodichev, A.M. and Ignatchenko, V.A.

TITLE: Dynamics of the Barkhausen Jump

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 6, pp 903 - 908 (USSR)

ABSTRACT: The authors investigated the character of the movement of the domain boundary during a Barkhausen jump. The Barkhausen jump is attributed to the following mechanism: in the case of a slow increase of the magnetic field H the boundary between domains displaces in such a way that at each instant of time the conditions of the sum of all magnetic energies having a minimum are fulfilled. If the boundary hits a barrier, it may impede its movement. In this paper a solution is obtained of the equation of motion which has been written taking into consideration the basic forces acting on the boundary and formulae are derived which establish the dependence of the duration and speed of the process on various characteristics of the ferromagnetic. In another paper (Ref 8), the authors report on the measurement of the distribution of Barkhausen jumps as a function of pulse durations in

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S/126/60/009/06/015/025
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Dynamics of the Barkhausen Jump

nickel specimens for pulses of durations between 2 and 30 μs. The analysis of the results of this experiment published in earlier work (Ref 2) leads to the conclusion that the real durations of the jumps did not exceed 1 μs. Evaluation by means of Eq (14) of this paper for an equal specimen yields time values which are not contradictory to these conclusions.
There are 3 figures and 8 references, 3 of which are English, 2 French, 1 German and 2 Soviet.

ASSOCIATION: Institut fiziki AN SSSR (Institute of Physics of the Ac.Sc. USSR)

SUBMITTED: December 15, 1959

VB

Card 2/2

AP4010315

S/0048/64/028/001/0169/0171

AUTHOR: Salanskiy, N.M.; Logutko, A.E.; Rodichev, A.M.

TITLE: Curve of equilibrium states in magnetization of a silicon iron crystal /Report, Symposium on Questions of Ferro- and Antiferromagnetism held in Krasnoyarsk, 25 June to 7 July 1962/

SOURCE: AN SSSR. Izvestiya, seriya fizicheskaya, v.28, no.1, 1964, 169-171

TOPIC TAGS: equilibrium magnetization state, ferromagnetic domain, ideal magnetization curve, domain structure, silicon iron, ferromagnet, magentic theory

ABSTRACT: The purpose of the work was to obtain the ideal magnetization curve for a cilicon iron single crystal and to investigate its domain structure in equilibrium states corresponding to different values of the external field. The purpose of the experiments was to check the thermodynamic theory of V.A.Ignatchenko, I.F.Degtyarev and Yu.V.Zakharov (Izv.AN SSSR,Ser.fiz.25,12,1961), which predicts, for a case of this type, decrease in the total number of domains and decrease in the width of the disadvantageously oriented domains. The 3.5% Si iron single crystals were etched and polished on two sides and annealed following the standard procedure. The di-

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mensions of the specimens were 10 x 10 x 0.15 mm; this size was deliberately chosen to be close to the values used in the numerical calculations performed in the above mentioned reference. The plane of the specimens was parallel to within 1-3° to the (110) planes and one of the sides was aligned with the 100 direction. The external field was applied in this direction. From among the 80 prepared specimens there were selected four with uniform plane-parallel domain structure over the entire specimen. The equilibrium states were obtained by demagnetization with a gradually decreasing alternating field in the presence of the desired constant field. Photographs of the domain structure are reproduced. The experimental results confirm the theoretical prediction of decrease in the number of domains with increase of the applied field. The average domain width versus field curve is also close to the theoretical curve. The ideal magnetization curve obtained from ballistic measurements agrees with the magnetization curve plotted on the basis of the domain areas. Orig.art.has: 3 figures.

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics, Siberian Department, Academy of Sciences, SSSR)

SUBMITTED: 00 DATE ACQ: 10Feb64 ENCL: 00

SUB CODE: PH NR REF SOV: 006 OTHER: 002

Card 2/2

KIRENSKIY, L.V.; SAVCHENKO, M.K.; RODICHEV, A.M.

Dynamics of the domain structure in crystals of transformer steel subjected to stresses. Izv. AN SSSR. Ser. fiz. 22 no.10: 1181-1184 O '58. (MIRA 12:3)
(Steel--Metallography)

AUTHORS: Kirenskiy, L. V., Savchenko, M. K., SOV/48-22-10-4/23
Rodichev, A. M.

TITLE: Dynamics of Domain Structure in Crystals of Transformer Sheet Iron Under the Influence of Tensions (Dinamika domennoy struktury v kristallakh transformatornoy stali pod deystviyem napryazheniy)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1958, Vol 22, Nr 10, pp 1181 - 1184 (USSR)

ABSTRACT: By means of the powder patterns by Akulov, Dekhtyar, and Bitter (Ref 1) in the present paper the effect of elastic strain on the domain structure of the crystals of cold-rolled transformer sheet iron (3,4% Si) was investigated. It was shown that the domain structure changes considerably when a strain is applied. The character of these changes depends on the orientation of the stress. On the crystal surface that coincides with the plane (110) the powder pattern has the form of parallel lines. These lines have the direction of the axis of the weak magnetization which is next to the surface. This speaks for the fact that the domain structure consists of plane-parallel layer domains.

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These layer domains are oriented in the direction of the powder lines and are magnetized in the same direction. The plane-parallel layer domains never exhibit the same width in one and the same sample. The application of the stress to the sample compensates for the whole tension in the sample and thus also for the domain structure. During strain application sometimes a separation of the layer domains into two halves can be observed. This separation comes as a consequence of new boundaries, (Fig 1). It must be mentioned that the remagnetization of a number of domains is not caused by the dislocation of the boundary but apparently by a sudden inversion of whole domains. Tensions that are directed along the axis (110) in the crystal completely rebuild the original structure of the domains. If the stress is sufficiently high two new types of figures appear (Fig 2). For reasons of comparison also finely crystalline samples with a linear grain dimension of 1 - 1,5 mm were observed. A more or less simple law connecting the width and the magnitude of the stress could not be found.

Dynamics of Domain Structure in Crystals of Transformer Sheet Iron Under the Influence of Tensions SOV/48-22-10-4/23

As was observed, the domain structure changes when the stress is oriented along the direction of the complex magnetization as well as when it is directed along the axis of the weak magnetization. In crystals the surface of which coincides with the plane (100) a change of the domain structure of the closed type was observed when a strain was applied. Reproductions of powder patterns show that the layered structure of the ferromagnetic domains must exhibit closed domains for excluding the formation of free stray-fields. The powder pattern method alone is not perfect and may be applied more successfully if it is combined with another method. In the present paper apart from observations of powder patterns also the Barkhausen (Barkgauzen) jumps were recorded. Figure 4 shows the results. There are 4 figures and 2 references, 1 of which is Soviet.

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AP 4010313 S/0048/64/028/001/0161/0163

AUTHOR: Salanskiy, N.M.; Rodichev, A.M.

TITLE: Duration of Barkhausen pulses in ferromagnets [Report, Symposium on Questions of Ferro- and Antiferromagnetis held in Krasnoyarsk, 25 June - 7 July 1962]

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.28, no.1, 1964, 161-163

TOPIC TAGS: Barkhausen jumps, Barkhausen pulses, magnetization reversal, nickel, permalloy, thin film, permeability

ABSTRACT: Investigation of the time characteristics of the Barkhausen effect is of interest because in bulk ferromagnets the duration of the Barkhausen jumps is one of the factors determining the frequency characteristics of the noise spectrum in cyclic magnetization reversal, while in the case of thin films the duration of the Barkhausen pulses can yield interesting information on the character of relaxation of the magnetic moment and the rate of displacement of domain walls. In the present work the duration of the Barkhausen pulses was measured for bulk specimens of nickel (with 1% Cr) in the form of rods with radii 0.06, 0.12, 0.21 and 0.31 mm, but all characterized by identical hysteresis loops. The duration of the pulses

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was measured by means of a somewhat improved version of the procedure described earlier (A.M.Rodichev, N.M.Salanskiy and V.I.Sinegubov, Izv.SO AN SSSR,No.3,123,1960). The experimental results are presented in the form of curves. Analogous measurements were carried out for 1700 Å thick permalloy films with the reversing field applied in the directions of easy and difficult magnetization. The mean duration of the Barkhausen pulses with the reversing field applied in the easy direction was 4.8 microsec; in the difficult direction - 1.95 microsec. This difference is attributed to differences in the Barkhausen jump mechanism. Orig.art.has: 2 formulas and 4 figures.

ASSOCIATION: Institut fiziki, Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics, Siberian Division, Academy of Sciences, SSSR)

SUBMITTED: 00 DATE ACQ: 10Feb64 ENCL: 00

SUB CODE: PH NR REF SOV: 004 OTHER: 000

Card 2/2

RODICHEV, A.M.; SALANSKIY, N.M.; SINEGUBOV, V.I.

Statistical distribution of Barkhausen pulses by duration. Izv.Sib. otd.AN SSSR no.3:123 '60. (MIRA 13:10)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.
(Ferromagnetism)

86898

147900 (1035, 1055, 1160)

S/056/60/039/005/015/051
B029/B079

AUTHORS: Kirenskiy, L. V., Ignatchenko, V. A., Rodichew, A. M.

TITLE: The Behavior of a Domain Structure Under the Influence of Elastic Tensions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 5(11), pp. 1263-1268

TEXT: Using a thermodynamic method devised by L. D. Landau and Ye. M. Lifshits the authors studied an iron-type crystallite whose surface coincided with the (001) plane. They assume the existence of partially overlapping domains whose width can assume values between 0 and D (D denotes the width of the principal domains). In this paper, the free energy of such a structure is calculated. The coordinates are assumed to coincide with the tetragonal axes of the crystallite, and the dimensions of the crystallite along the coordinates are denoted by x_0, y_0, z_0. Using the method of Ch. Kittel (Ref. 2) for the calculation of the energy of the magnet poles, one obtains

$$\gamma_k = \frac{4\omega^2 D}{\pi^2}\left[1{,}05 + \sum_{m=1}^{\infty}\frac{\cos(2m-1)\pi k}{(2m-1)^3}\right], \quad (1.1)$$

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The Behavior of a Domain Structure Under the Influence of Elastic Tensions

S/056/60/039/005/015/051
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where ω denotes the surface density of the magnet poles. Moreover, $k = d/D$. $f(k)$, that is, the expansion appearing in the brackets of (1,1) was calculated by means of the tables compiled by K. A. Kitover (Ref. 11). For estimates, $f(k) = 5.28k^3 - 6.84k^2 + 2.1$ for $k \leqslant 0.5$, and $f(k) = 5.28k^3 - 9k^2 + 2.16k - 1.56$ for $k \geqslant 0.5$. If the face of the crystallite does not coincide exactly with [001], the energy of the magnet poles is $F_M^{\ast} = 1.7\, I_s^2 \sin^2\theta \cdot 2D/(1 + \mu^{\ast})y_o = aD/y_o$, where $\mu^{\ast} = 1 + 2\pi I_s/K$. θ denotes the angle between the crystallite face and the direction [001], and K denotes the constant of magnetic anisotropy. In the principal domains and also in the closing domains there is an equilibrium state with a complicated distribution of the stress tensor. The authors assume that a deformation exists only in the direction of the x-axis, and they calculate the density of energy in the closing domains. In this case, the total free energy of the structure amounts to $F = F_m + F_m^{\ast} + F_{m.s} + F_g + F\sigma$. Here, $F_m = (8\omega^2/\pi^2 z_o)Df(k)$ denotes the energy of the magnet poles; f_g is the total

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energy (γ is the surface density of the boundary energy); $F_{ms} = c_2\lambda_{100}^2 Dk^3/2z_o$ is the magnetostriction energy; and

$$F_o = -\frac{3}{2}\lambda_{100}\sigma\left(\cos^2\varphi - \frac{1}{3}\right) + \frac{3}{4}\lambda_{100}\sigma\cos 2\varphi\,\frac{Dk^2}{z_0}$$

where φ denotes the angle between the stress direction and the z-axis. The second part of the present paper deals with the behavior of a structure under the influence of stress. For any value of σ, the equilibrium state of the structure is defined by the conditions $\partial F(D,k)/\partial D = 0$, $\partial F(D,k)/\partial k = 0$ wherefrom the equations

$$D = \left[\frac{\gamma z_0}{az_0/y_0 + 8\omega^2\pi^{-2}f(k) - c_2\lambda_{100}^2 k^3/2 + 3/4\lambda_{100}\sigma k^2\cos 2\varphi}\right]^{1/2},$$

$$(16\omega^2/3\pi^2)f'(k) + \lambda_{100}^2 c_2 k^2 + \lambda_{100} k\sigma\cos 2\varphi = 0.$$

follow. If there is no stress in the crystallite, one of three structures, a, b, or c, will appear, depending upon the value of ω. If structure a is assumed to be stable, and if a uniform expanding stress is applied at an angle greater than $\pi/4$ relative to the z-axis, closing (b) appear at a certain value of σ. They increase until the total closing (c) is reached. In this case, D may either increase or decrease. Then, part of the closing

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domains increases, while the other part decreases. If σ increases, the closing domains decrease until structure h is formed. The accompanying figure shows the consecutive stages of change in the domain structure under expansion. Ya. S. Shur and V. A. Zaykova (Ref. 7) observed also a transition from f to g. The calculations described in the present paper agree well with the known experiments and demonstrate the possible existence of structure e. There are 7 figures and 11 references: 9 Soviet and 2 US.

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Physics of the Siberian Branch of the Academy of Sciences USSR)

SUBMITTED: March 24, 1960

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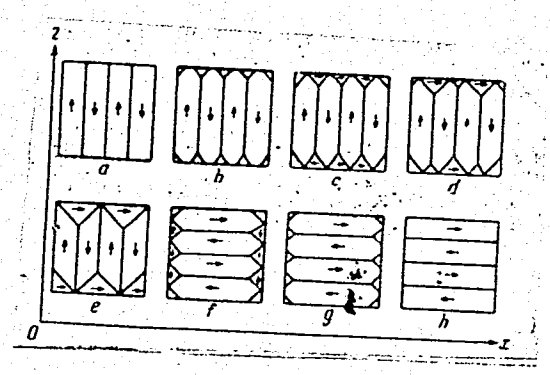
B029/B079



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RODICHEV, A-N.

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PHASE I BOOK EXPLOITATION SOV/5526

Vsesoyuznoye soveshchaniye po magnitnoy strukture ferromagnetikov, Krasnoyarsk, 1958.

Magnitnaya struktura ferromagnetikov; materialy Vsesoyuznogo soveshchaniya, 10 - 16 iyunya 1958 g., Krasnoyarsk (Magnetic Structure of Ferromagnetic Substances; Materials of the All-Union Conference on the Magnetic Structure of Ferromagnetic Substances, Held in Krasnoyarsk 10 - 16 June, 1958) Novosibirsk, Izd-vo Sibirskogo otd. AN SSSR, 1960. 2[illegible] p. Errata slip inserted. 1,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut fiziki Sibirskogo otdeleniya. Komissiya po magnetizmu pri Institute fiziki metallov OFMN.

Resp. Ed.: L. V. Kirenskiy, Doctor of Physical and Mathematical Sciences; Ed.: R. L. Dudnik; Tech. Ed.: A. F. Mazurova.

PURPOSE: This collection of articles is intended for researchers in ferromagnetism and for metal scientists.

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Magnetic Structure (Cont.) SOV/5526

COVERAGE: The collection contains 38 scientific articles presented at the All-Union Conference on the Magnetic Structure of Ferromagnetic Substances, held in Krasnoyarsk in June 1958. The material contains data on the magnetic structure of ferromagnetic materials and on the dynamics of the structure in relation to magnetic field changes, elastic stresses, and temperature. According to the Foreword the study of ferromagnetic materials had a successful beginning in the Soviet Union in the 1930's, was subsequently discontinued for many years, and was resumed in the 1950's. No personalities are mentioned. References accompany individual articles.

TABLE OF CONTENTS:

POLIVANOV, K.M.; RODICHEV, A.M.; IGNATCHENKO, V.A.

Effect of the parameters of ferromagnetic materials on the Barkhausen Effect measurements. Fiz. met. i metalloved 9 no.778-789 My '60. (MIRA 14:4)

1. Institut fiziki AN SSSR.
(Ferromagnetism)

KIRENSKIY, L.V.; IGNATCHENKO, V.A.; RODICHEV, A.M.

Behavior of domain structure under the action of elastic stresses.
Zhur.eksp.i teor.fiz 39 no.5:1263-1268 N '60. (MIRA 14:4)

1. Institut fiziki Sibirskogo otdeleniya AN SSSR.
(Iron crystals)

25796
S/048/61/025/005/010/024
B104/B201

24,2200

AUTHORS: Salanskiy, N. M., Rodichev, A. M., and Savchenko, M. K.

TITLE: Barkhausen effect in thin molybdenum permalloy films

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 5, 1961, 602-605

TEXT: The present investigation was the subject of a lecture delivered at a symposium on thin ferromagnetic films (Krasnoyarsk, July 4 to 7, 1960). In the course of the experiments reported here, the films were inserted into a test coil, the outputs of which were connected to a broad-band amplifier. The magnetic reversal was attained by a continuous change of the current in a magnetic coil which was arranged coaxially with the test coil. The changing velocity was varied within a wide range. Behind the amplifier the Barkhausen pulses were integrated electronically and sorted by an eight-channel integral pulse discriminator with respect to the magnetic moments. The system allowed recording magnetic moments of $0.56 \cdot 10^{-6}$ CGSM units and over. The films (80% Ni, 17% Fe, 3% Mo) were prepared by sputtering onto glass backings (300°C) in vacuum ($4 \cdot 10^{-5}$mm Hg),

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and thereafter annealed at 300°C in the same vacuum. Eight films (25 • 2 mm) were prepared. Four films, no. 1 (600 Å), no. 2 (750 Å), no. 3 (850 Å), and no. 4 (1200 Å) were annealed in the laboratory in the presence of the natural magnetic field; three films, no. 5 (600 Å), no. 6 (750 Å), and no. 7 (1200 Å) were annealed in a 100-oe magnetic field which was oriented in the direction of the long side; film no. 8 (1200 Å) was annealed with a 100-oe field, oriented in perpendicular to the long side of the specimen. A disk-shaped specimen (no. 9, 11 mm in diameter) was likewise annealed in a 100-oe magnetic field. Easiest magnetizing was in all films, with the exception of no. 8, directed along the long side of the film. In case of no. 8 easiest magnetizing was directed in perpendicular to the long side. The specimens 1 - 8 were inserted with their long side in parallel to the axis of the test coil. The investigation was extended to the distribution of jumps according to their moments, jumps as a function of the film thickness, the distribution of jumps according to the field strength, and the number of jumps as a function of the rate of magnetic field change. The results are presented in diagrams. It is stated in conclusion that some of the characteristics of the effect may be used as criteria of the rate of pulsed magnetic reversal of the

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Barkhausen effect in thin ... S/048/61/025/005/010/024
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films. The fastest film underwent magnetic reversal with one jump. The nonsynchronous magnetic reversal of individual parts of the film increases the time of magnetic reversal. The authors believe that the duration of the jumps is closely related to the characteristics of pulsed magnetic reversal. There are 5 figures and 3 non-Soviet-bloc references.

ASSOCIATION: Institut fiziki Sibirskogo otdeleniya Akademii nauk SSSR
(Institute of Physics, Academy of Sciences USSR)

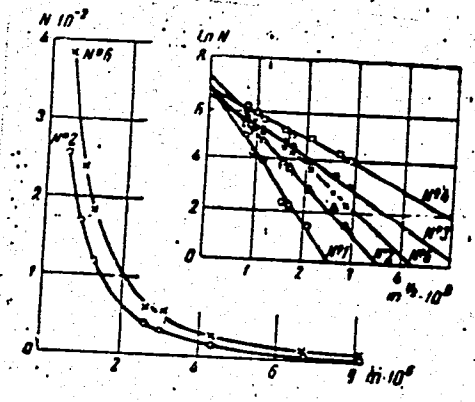

Fig. 1: Integral jump distribution versus magnetic field strength for specimens nos. 2 and 6.

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25799
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B117/B201

24.2200

AUTHOR: Rodichev, A. M.

TITLE: Theory of the magnetic reversal of thin films in strong fields

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 5, 1961, 614-618

TEXT: The present investigation was the subject of a lecture delivered at a symposium on thin ferromagnetic films (Krasnoyarsk, July 4 to 7, 1960). The author has studied the problem of the magnetic reversal of thin ferromagnetic films under uniform rotation of the magnetizing field. A thin ferromagnetic film is examined in the xy-plane after having been magnetized in the x direction (Fig. 1). The anisotropy field in the plane of the film is $H_{ax} = (2K/M_s)\cos\varphi = n_1\cos\varphi$. Here, K is the anisotropy constant (the energy of anisotropy is satisfactorily described by $E = K\sin^2\varphi$), M_s - saturation magnetization; φ - azimuth angle, counted from the x-axis. The anisotropy field is $H_{az} = -N_f M_s\cos\vartheta = -n\cos\vartheta$. Here, ϑ

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denotes the angle counted from the z-axis; N_f is the demagnetization factor in the z-direction. The field $H_e = -H_x$, which causes magnetic reversal and which is larger than the anisotropy field, and a smaller field H_y in y-direction are applied to the film. Proceeding from the Gilbert equation

$$\dot{\vec{M}} = \gamma[\vec{H}\vec{M}] + \frac{a}{M}[\vec{M}\dot{\vec{M}}] \qquad (1)$$

equations

$$\frac{1+a^2}{\gamma}\dot{\beta} = H_e \sin\varphi - n_1 \cos\varphi \sin\varphi + H_y \cos\varphi + a\beta(H_e \cos\varphi - n_1 \cos^2\varphi - n - H_y \sin\varphi), \qquad (4)$$

and

$$\frac{1+a^2}{\gamma}\dot{\varphi} = -\beta(H_e \cos\varphi - n_1 \cos^2\varphi - n - H_y \sin\varphi) + a(H_e \sin\varphi - n_1 \cos\varphi \sin\varphi + H_y \cos\varphi). \qquad (5)$$

are derived. An exact solution of such equations is possible by numerical methods only. Their solution has been found by a rough approximation, taking $\beta = 0$:

$$\dot{\varphi} = \frac{\gamma}{a}(H_e \sin\varphi - n_1 \cos\varphi \sin\varphi + H_y \cos\varphi) \qquad (6).$$

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Theory of the magnetic reversal of ...

The same equation had been obtained in Ref. 5 (Olsen C. D., Pohm A. V., J. Appl. Phys. 29, 3, 274 (1958)) in another manner. Since $M_x = M_s \sin\psi$, the form of the magnetic reversal pulse must be determined by formula

$$M_x = -M_s \frac{\gamma}{a} \sin^2(H_e \sin\psi - n_1 \cos^2 \sin\varphi - H_y \cos\psi) \quad (7).$$

Some special cases have been examined. A confrontation of theory with experimental results clearly refutes the theory of uniform rotation. To summarize: the magnetic reversal process of thin ferromagnetic films and ferromagnetic materials is much more complicated than is contemplated by current conceptions. The ground state of a ferromagnetic film (or ferrite) is characterized by a determined distribution of spin waves related to the respective temperature (Ref. 15: Akhiyezer A. I., Bar'yakhtar V. G., Kaganov M. I., Uspekhi fiz. nauk, 71, 4, 533 (1960)). It has been shown in Ref. 16 (Bulayevskiy L. N., Fayn V. M., Freydman G. I., Zh. eksperim. i teor. fiz., 39, 2(8) 516 (1960)) that if the angle φ between $\overline{H}$ and $\overline{M}$ is larger than $\pi/2$, the spin waves will grow irreversibly; in this connection, waves with different φ will have different rates of growth. Due to a high demagnetization factor only such spin waves will grow in thin films on the

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Theory of the magnetic reversal of ...

z-axis, whose $\vec{k}$ is positioned in the film plane. Due to the fact that $\vec{k}$ of individual spin waves is directed both to the right and the left of the x-axis, there will be, correspondingly, "right-hand" and "left-hand rotating" parts of magnetization. This phenomenon was observed by Olson and Pohm (Ref. 5). Under these conditions it is natural that the existence of fields of the $\alpha\nabla^2\vec{M}$ type, the reciprocal influencing of noncophasal parts of ferromagnetic materials undergoing magnetic reversal, causes magnetic reversal to be considerably slower compared with the case of a regular precession, and the effective relaxation constant to be correspondingly higher. Applying H_y disturbs the symmetry of the process, and one of the rotation directions of magnetic moments prevails. The factors retarding the process are somewhat reduced in this case.

K. M. Polivanov, V. V. Kobelev, and I. A. Yefimov are thanked for having put manuscripts at the author's disposal. There are 3 figures and 16 references: 5 Soviet-bloc and 11 non-Soviet-bloc. The four references to English-language publications read as follows: Conger R. L., Essig F. C., J. Appl. Phys., 104, 4, 915 (1956); Smith D. O., J. Appl. Phys., 29, 3, 264 (1958); Humphrey F. B., Gyorgy E. M., J. Appl. Phys., 30, 6, 935 (1959); Manzel A. L. Conger R. L., J. Appl. Phys., 28, 8, 855 (1957).

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