SHUR, Ya. S.; KHOKHLOV, A. S.

Appearance of a Stable Magnetic Texture in Ferromagnetics Cooled under Elongation

ZHETF 10, 1113, 1940

SHUR, YA. S.

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A10

• The Effect of Elastic Stresses on Magnetization Processes in Ferromagnetics [Iron, Nickel, and Transformer Steel] in Weak Fields. V. I. Drozzina and [illegible]. *Physics* (*U.S.S.R.*), 1941, 4, (5), 393-399.—[In English.] The effect of elastic stresses on magnetization processes in weak fields up to [illegible] was studied for specimens of iron, nickel, and transformer steel. For each field intensity and each load (extension), the induction was measured (*a*) on the annealed unstrained state, (*b*) after loading before magnetization, (*c*) after magnetization and subsequent loading, and (*d*) after unloading in the presence of the magnetizing field. The results are shown graphically. Loading before magnetization causes an increase in induction for iron, which is directly proportional to the load. For nickel a decrease is observed except at slight loads. Loading in the presence of the field causes an increase of induction for iron. Unloading in the presence of the field gives smaller effects. For nickel, loading in the presence of the field causes an increase in induction at light loads, but a marked decrease at large loads. The results are qualitatively interpreted in terms of the opposing effects of field and stresses on the displacement of the boundaries of the regions of spontaneous magnetization in the metal.—G. V. R.

19-15

The Anisotropy of Hysteresis in Ferromagnetic Single Crystals. III. The Effect of Thermal Treatment in a Magnetic Field Upon the Character of the Anisotropy of the Coercive Force in Ferromagnetic Single Crystals. [illegible] *Journal of Physics (U.S.S.R.)*, 1941, 4, (5), 439–447.—[In English.] The effect of thermal treatment in a magnetic field on the character of the coercive force along various crystallographic directions was investigated for discs of transformer steel (3·5% silicon) obtained as single crystals. The crystallographic orientation of the discs was determined by the Laue method, and the coercive force measured along various directions in the plane of the discs before the treatment, and after slow cooling from 800° C. in a magnetic field of 600 oe. The coercive force H_c was plotted against the angle between the direction of the magnetic field and a certain marked diameter in the plane of the disc for several values of the angle between the same line and the direction of the field applied during thermal treatment. Results showed that the value of H_c remained constant or decreased during thermal treatment in the magnetic field; the magnitude of the decrease depended on the crystal direction along which the field was applied during treatment. If in the initial state the specimen possessed little anisotropy in H_c, then after treatment the minima in H_c were sharply diminished; if the anisotropy was initially considerable, thermal treatment caused a decrease of the maxima in H_c with a nearly constant value of H (min.). It is suggested that to obtain maximum effect by combining the factors of preferred orientation and thermal treatment in a magnetic field, the following treatment should be applied to technical materials: a texture should be created such that two tetragonal axes are located in the plane of the specimen, and the field during thermal treatment should be orientated in the direction of H_c (min). This procedure may give rise to a 20% decrease in coercive force.—G. V. R.

SHUR, Ya. S.

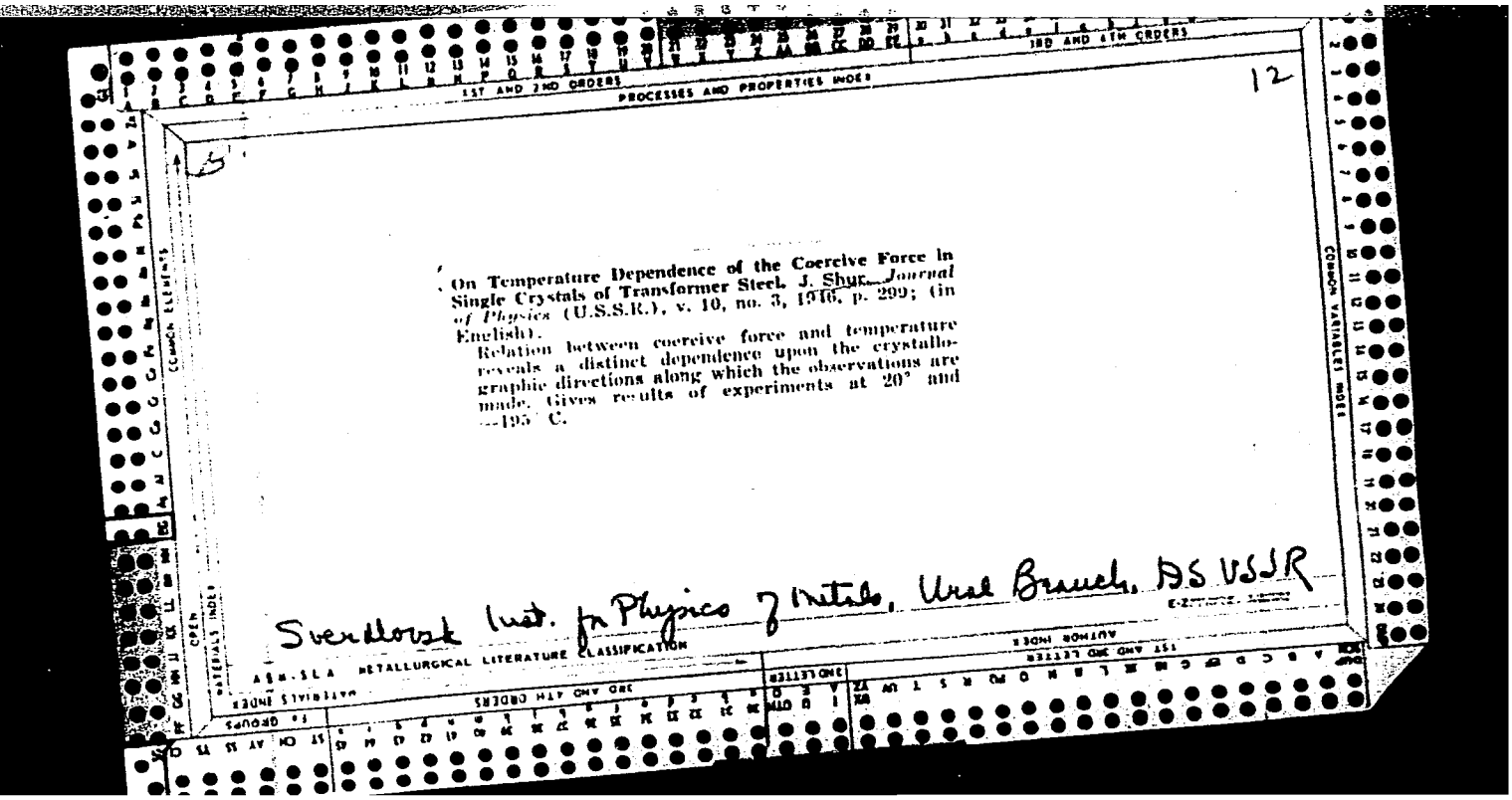
Certain Physical Methods to Improve Magnetic Materials.

Leningrad Physico-Technical Institute, 1942.

So: U-1837, 14 April 52.

VONSOVSKIY, S. V., SHUR, Ya. S.

Magnetic Defectoscoping of the Bodies of Artillery Shells(Monograph). Izd. AN SSSR. 1946.



On Temperature Dependence of the Coercive Force in Single Crystals of Transformer Steel. J. Shur. *Journal of Physics* (U.S.S.R.), v. 10, no. 3, 1946, p. 299; (In English).

Relation between coercive force and temperature reveals a distinct dependence upon the crystallographic directions along which the observations are made. Gives results of experiments at 20° and —195° C.

Sverdlovsk Inst. of Physics & Metals, Ural Branch, AS USSR

SHUR, Ya. S.

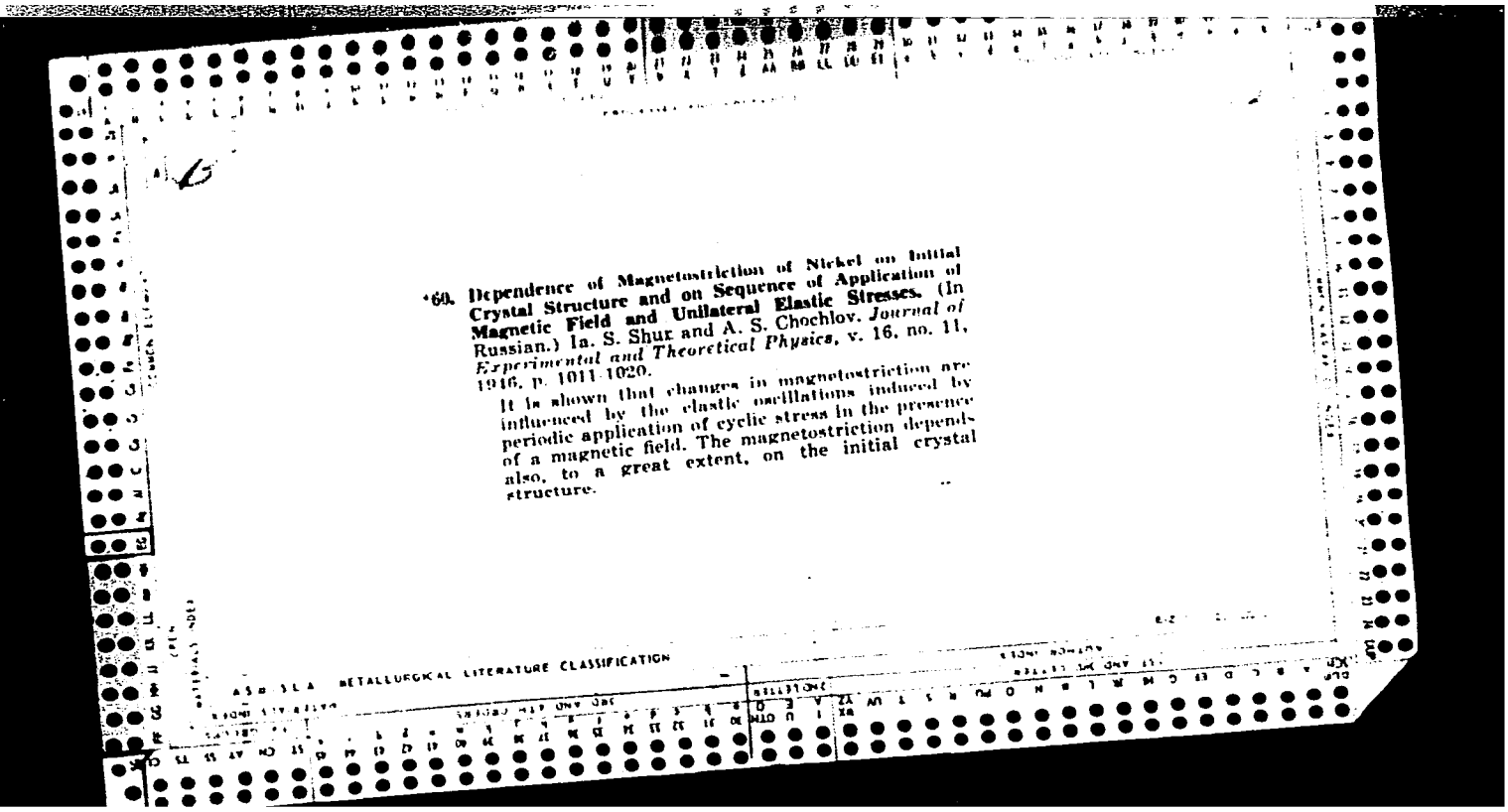
USSR/Physics Nov/Dec 1946
Magnetostriction
Thermomagnetic Effect

"Magnetostriction of Transformer Steel Subjected to Thermomagnetic Treatment," Y. Shur, A. Khokhlov, Ural Affiliate, Acad Sci USSR, Inst Metal Phys, 3 pp

"Journal of Physics USSR" Vol X, No 6

Plots magnetostriction curves for unidirectional elastic tension, and compares curves showing that in transformer steel thermodynamic treatment leads to a sharply pronounced texture which manifests itself weakly on the magnetization curves. Received, 27 Feb 1946.

54T81



*60. **Dependence of Magnetostriction of Nickel on Initial Crystal Structure and on Sequence of Application of Magnetic Field and Unilateral Elastic Stresses.** (In Russian.) Ia. S. Shur and A. S. Chochlov. *Journal of Experimental and Theoretical Physics*, v. 16, no. 11, 1946, p. 1011-1020.

It is shown that changes in magnetostriction are influenced by the elastic oscillations induced by periodic application of cyclic stress in the presence of a magnetic field. The magnetostriction depends also, to a great extent, on the initial crystal structure.

SHUR, J. PA 13T75

USSR/Magnetostriction Nov 1946
Nickel

"The Dependence of the Magnetostriction of Nickel on Initial Magnetic Texture and the Order of Applying Magnetic Fields and Unilateral Elastic Strains," J. Shur, A. Khokhlov, 10 pp

"Zhur Eksp i Teor Fiz" Vol XVI, No 11

Published in English in the Journal of Physics of the USSR, 11, No 1, 1947.

13T75

Materials & Treatment Techniques

W. E.

1951

Thermomechanical Treatment of Ferromagnetic Materials. —J. S. Shur & A. S. Khokhlov (Inst. Metal Physics, Ural Br. Acad. Sci. U.R.S.S.) Izdat. Akad. Nauk SSSR, July 1946. Vol 11 No 1 pp 39-46. (In English.) The magnetic properties of a material can be improved by subjecting it to elastic tension or compression while it is cooled from a temperature above the Curie point to room temperature. For maximum effects, (a) tension must be used for positive and compression for negative magnetostriction materials, (b) the Curie point must be high enough to permit the release of magnetostriction stresses by annealing, (c) the magnitude of the load must have a certain optimum value, and (d) the energy of magnetostriction stresses produced by elastic stresses must be comparable to the energy of magneto anisotropy

1948 Inst of Metal Physics, Ural Br. AS USSR

SHUR, YA. S.

PA 36T92

USSR/Physics
Magnetostriction
Ferromagnetism

Sep/Oct 1947

"Magnetic Properties of Ferromagnets Cooled in the Presence of a Unilateral Tension," Ya. S. Shur, Institute of Physics of Metals, Ural Branch, Academy of Sciences of the USSR, 9½ pp

"Izv Ak Nauk, Ser Fizich" Vol XI, No 5

Describes the studies which were conducted to determine the effect of thermomechanical processing on the path of magnetization curves and the magnetostriction of several ferromagnetic materials. The purpose of these experiments was to explain the nature of magnetic

LC 36T92

USSR/Physics (Contd) Sep/Oct 1947

texture, which arises as a result of thermomechanical processing, as well as the possibility of premediated changes in magnetic properties by means of this treatment. Discusses the selection of samples, methods and sequence of their measuring, and the results of the measurements and evaluation of results. Samples included nickel, permalloy and ferroceramics.

LC 36T92

SHUR, YA. S.

USSR/Physics Sep/Oct 1947
Hysteresis, Magnetic
Ferromagnetism

"Temperature vs. Magnetic Hysteresis in Ferromagnets," V. I. Drozhzhina, Ya. S. Shur, Institute of Physics of Metals, Ural Branch, Academy of Sciences of the USSR, 5 pp

"Izv Ak Nauk, Ser Fizich" Vol XI, No 5

An account of work which was conducted to study the effect of temperature on the magnetic hysteresis factor of samples of nickel and ferroceramics with the purpose of determining the basic regularities of this phenomena. All the experiments were conducted on long, thin samples and at temperatures ranging from -195° C to as high as 730° C. IC 36T93

USSR, [illegible]

USSR/Phys
Magnetite
Magnetic Permeability Nov/Dec 1947

"Accommodation of the Magnetic Permeability of Magnetite," R. I. Yanus, Ya. S. Shur, V. V. Druzhinin, A. M. V'yukhina, Ural State U imeni A. M. Gor'kiy, 1½ pp

"Izv Akad Nauk SSSR, Ser Fiz" Vol XI, No 6

It was established experimentally that some varieties of magnetites when broken down into fine powder exhibit in very sharp form capacity for accommodation and disaccommodation of magnetic permeability. If the magnetite is subjected to magnetic reversal several times after lying for some time outside accommodating influences, the permeability increases noticeably. If it is then kept outside and accommodating influence, however, it again gradually returns to former condition.

PA 57T76

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Influence of processes of recovery and recrystallization on the magnetic properties of ferrosilicon. Ya. S. Shur, V. I. Drozhzhina, and M. G. Luzhinskaya (Acad. Sci., U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 11, No 6, 576–8(1947).—Transformer sheet steel after vacuum firing at 1100° (2 hrs.) and 7% stretching was heat treated at different temps. Recrystd. samples had the best magnetic properties. S. Pakswer

INST. Physics of Metals, URAL BRANCH, Acad Sci USSR

SHUR, Ya. S.

PA 57T79

USSR/Phys
Ferromagnetism
Magnetostriction

Nov/Dec 1947

"Magnetic Properties of Ferromagnetics," Ya. S. Shur, Inst Phys of Metals, Ural Br, Acad Sci USSR, 9 pp

"Izv Akad Nauk SSSR, Ser Fiz" Vol XI, No 6

Path of curves of magnetostriction and curves of magnetization in the field of weak magnetic poles, influence of elastic strains on path of magnetization curves, and change of electrical resistance of ferromagnetics in magnetic field, are used to discover magnetic properties of ferromagnetics and to study it in detail.

57T79

SHUR, J.

USSR/Magnetostriction Jan 1947
Transformers - Cores

"Magnetostriction of Transformer Steel Subjected to Thermomagnetic Treatment," J. Shur and A. Khokhlov, 5 pp

"Zhur Eksp i Teor Fiz" Vol XVII, No 1

Published in English in the Journal of Physics of the USSR, 10, No 6, 1946.

13T68

SHUR, Ya.S.

USSR

The temperature dependence of the coercive force in monocrystals of transformer steel. Ya. S. Shur. *Zhur. Eksptl. i Teoret. Fiz.* 17, 238-9(1947); *J. Phys. (U.S.S.R.)* 10, 294(1946)(in English); cf. *C.A.* 48, 5054a.—The change in the coercive force with temp. in transformer steel was detd. along two cryst. axes both of which are readily magnetized. Expts. showed that the temp. dependence in monocryst. samples was that which was typical for all ferromagnetic materials indicating that the anomalous results obtained on polycryst. samples were due to the presence of an axis along which magnetization was difficult.
J. Rovtar Leach

INST. Physics of Metals, URAL AFFIL, Acad. Sci USSR

SHUR, Ya S.

Apr 1947

USSR/Hysteresis, Magnetic
Ferromagnetism
Steel, Silicon
Steel, Nickel

"On Temperature Magnetic Hysteresis in Ferromagnetic Materials," J. S. Schur, V. I. Drozhina, 4 pp

"CR Acad Sci" Vol LVI, No 1

Experiments to reveal the fundamental laws of the phenomenon of magnetization in nickel and silicon (4% Si) steel specimens.

Also published in Zhur. Eksper. i Teoret. Fiz., 17, No. 7, 1947
8T83

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7

Change in electrical resistance (Thomson effect) of highly coercive alloys in magnetic fields. V. I. Drozhzhina and Ya. S. Shur. *J. Tech. Phys. (U.S.S.R.)* **18**, 149-52 (1948).—An attempt is made to explain the connection between the value of the coercive force and the relation of the signs of the longitudinal and transverse Thomson effects in a highly coercive alloy (Fe 58, Ni 27, Al 15%) in which the value of the coercive force can be changed over a wide range. Measurements made in fields up to 1000 oersteds in the longitudinal direction and up to 4000 oersteds in the transverse direction show that the anomalous character of the Thomson effect is maintained independently of the value of the coercive force (from 20 to 200 oersteds). The abs. value of the effect changes very little for a considerable difference in the value of the coercive force, and for a given value of coercive force the character of the change in the Thomson effect remains the same independent of the temp. and time of annealing. The anomalous effect also occurs with a 4% Si-Fe alloy, but not with a 52:10:38 Co-V-Fe alloy (with a coercive force of 300 oersteds) for which the longitudinal effect has a pos. sign and the transverse effect a neg. sign. B. A.

1951
Inst. Phys. Metals, Ural Affil. AS USSR, Sverdlovsk

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CA

Vonsovskiĭ, S. V., and Shur, Ya. S.: Ferromagnetism. Moscow: Gosudarst. Izdatel. Tekh.-Teoret. Lit. 1948. 816 pp. R.36 Kop. 80. Reviewed in *Uspekhi Fiz. Nauk* 36, 129(1948).

This paper was written mainly in prewar years and completed in 1946. for technical reasons the book was published in 1948.

SHUR, Ya. S.; DROZHZHINA, V. I.; LUZHINSKAYA, M. G.

"Influence of Relaxation and Recrystallization on the Magnetic Properties of Soft Magnetic Materials," Zhurnal Tekhnicheskoy Fiziki 18 (1948) No. 2, pp 167/174

Translation B-79119, 22 Sep 54

USSR/Physics
Magnetization
Permalloy

Apr 1948

"Observations on an Article by N. G. Ardashev, Ye. F. Svirina, and A. Ye. Bryukhanov, 'The Magnetization of Permalloy in a Constant Longitudinal Magnetic Field'," Ya. S. Shur, R. I. Yanus, Inst of Phys of Metals, Ural Br, Acad Sci USSR, Sverdlovsk, 1½ pp

"Zhur Tekh Fiz" Vol XVIII, No 4

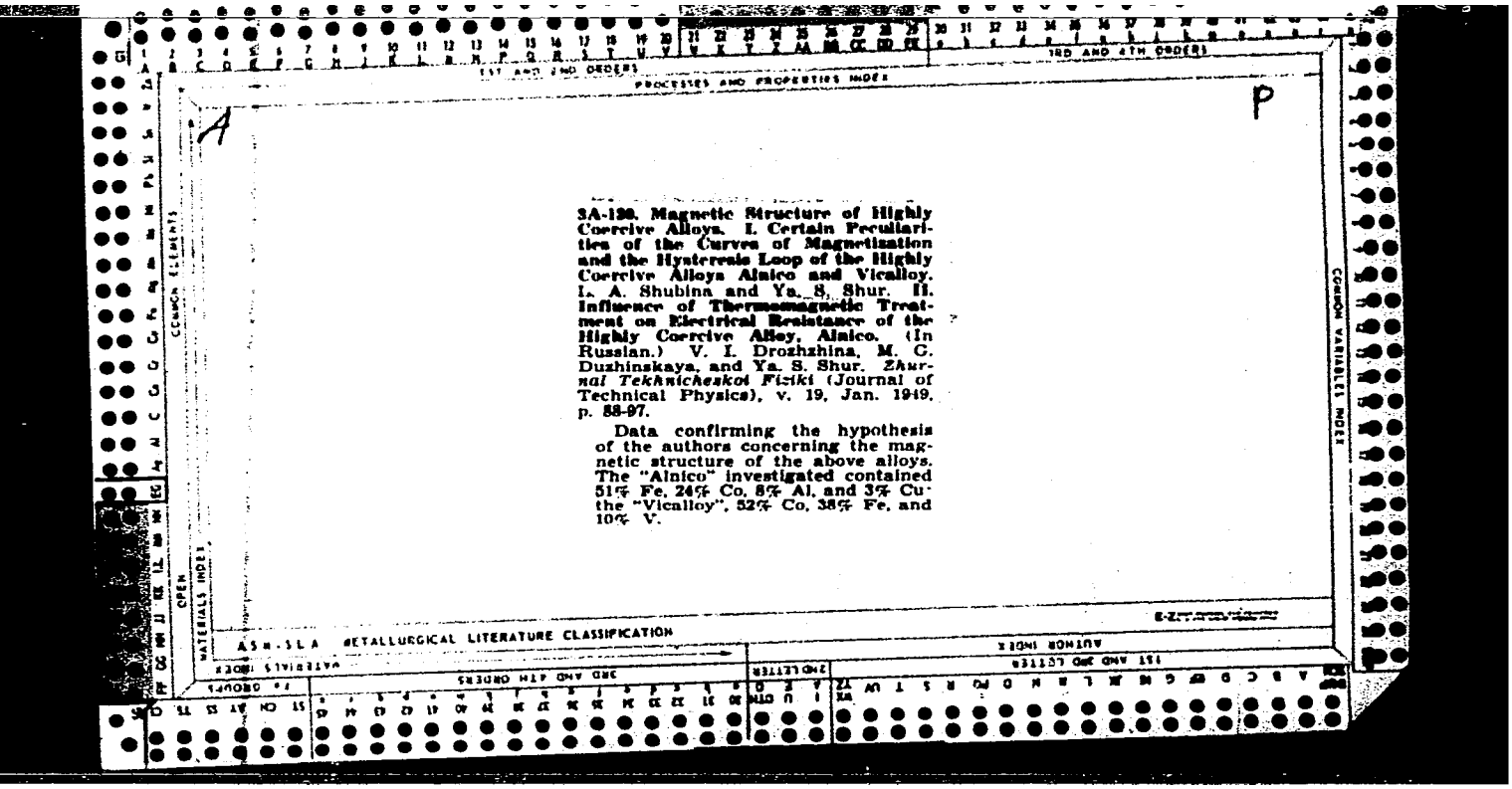
Briefs the discrepancies and deficiencies of subject article. Submitted 30 Apr 1947.

64T92

SHUR, YA. C.

35823 Rabot a instituta fiziki metallov ufan v oblasti fiziki magnitnykh materialov. Trudy in-ta fiziki metallov, vyp. 12, 1949, s. 62-73.— Bibliogr: 37 Nazv

SO: Leopis' Zhurnal'nykh Statey, No. 49, 1949



SA-138. **Magnetic Structure of Highly Coercive Alloys. I. Certain Peculiarities of the Curves of Magnetization and the Hysteresis Loop of the Highly Coercive Alloys Alnico and Vicalloy.** I. A. Shubina and Ya. S. Shur. **II. Influence of Thermomagnetic Treatment on Electrical Resistance of the Highly Coercive Alloy, Alnico.** (In Russian.) V. I. Drozhzhina, M. G. Duzhinskaya, and Ya. S. Shur. *Zhurnal TekhnicheskoI Fiziki* (Journal of Technical Physics), v. 19, Jan. 1949, p. 88-97.

Data confirming the hypothesis of the authors concerning the magnetic structure of the above alloys. The "Alnico" investigated contained 51% Fe, 24% Co, 8% Al, and 3% Cu; the "Vicalloy", 52% Co, 38% Fe, and 10% V.

SHUR, YA. S.

Feb 49

USSR/Metals
Aluminum Alloys
Magnetostriction

"The Magnetic Structure of Highly Coercive Alloys: III, Magnetostriction Curves of Highly Coercive 'Alniko' and 'Vikalloy' Alloys," D. A. Shturkin, Ya. S. Shur, Inst Phys of Metals, Ural Affilliate, Acad Sci USSR, 7½ pp

"Zhur Tekh Fiz" Vol XIX, No 2

Studies course of longitudinal and transverse magnetostriction of highly coercive "Alniko" and "Vikalloy" alloys in various magnetic texture states. Results can be satisfactorily explained by assuming that this class of ferromagnetics has special-type magnetic structure connected with fact that they contain finely dispersed, flat ferromagnetic formations - discs - isolated by nonferromagnetic layers, and that each disc comprises one field. Cooling in a magnetic field in the case of "Alniko," and tempering after preliminary strong-cold deformation in the case of "Vikalloy" causes flat formations to grow in an oriented manner. This in turn causes anisotropy of magnetic properties. Submitted 10 Jun 48.

PA 40/49T63

SHUR, Ya. S.

Temperature dependence of the coercive force in single crystals of transformer steel. Ya. S. Shur and K. B. Vlasov. *Doklady Akad. Nauk S.S.S.R.* 66, 1031-4(1949).—Expt. data were obtained on the variation of coercive force H_c, with temp. and direction of testing in 9 single-crystal disks of transformer steel by using a high-sensitivity magnetometer. The specimens were in vacuum during testing at high temps. The temp. dependence was studied either by taking polar isotherms, $H_c(\alpha)$, in the range −195 to +200°, where α was the angle between a fixed direction in the plane of the disk and the direction of testing in the plane of the disk, or by detg. the temp. dependence, $H_c(t)$, in the range −195 to +400° measured along directions corresponding to the max. and min. H_c on the polar isotherm. At temps. above 350 to 400° magnetization of the specimens was unavoidably produced by annealing that took place in the magnetic field. Also, during several hrs.' testing at temps. above 200°, H_c was increased 3 to 5% by aging. Two types of temp. dependence were found. The normal decrease of H_c with increasing temp. was observed in disks having only one max. and one min. as a result of cooling in a magnetic field. The difference between max. and min. in 2 typical disks was 0.09 to 0.25 oersted. The decrease from −200 to +200° was about 0.06 in each case. An anomalous increase in H_c with increasing temp. was observed in certain temp. ranges in disks that had a low abs. value of H_c (0.1 to 0.25), large anisotropy, and 2 max. and 2 min. The anomaly was observed only for directions of testing that corresponded to the max. and in a temp. range from −195 to +20. In a typical disk the variation of H_c with temp. was: −200°, 0.25; −50°, 0.26 (max.); 0°, 0.25; 100°, 0.22; 200°, 0.18. Aging effects could cause the anomaly to appear in all directions of testing. The normal temp. dependence of H_c was explained by the "theory of inclusions." The anomaly was explained in terms of competition between the energy of the demagnetizing field and the energy of crystallographic magnetic anisotropy or in terms of 90° as well as 180° displacement of domain boundaries.

A. G. Guy

Chemical Abst.
Vol. 48 No. 9
May 10, 1954
Metallurgy and Metallography

Inst. of Physics of Metals, Ural Affil., Acad. Sci. USSR

Effect of aging on the temperature-dependence curve of the coercive force in dynamo steel. Ya. S. Shur and K. B. Vlasov. *Doklady Akad. Nauk S.S.S.R.* 69, 337–8(1949).—The variation with time of the abs. value of the coercive force, H_c, is studied for Fe-Si (1% Si) aged at 200–300°. The aging effect is greatest in samples oxidized by being heated rapidly in air to 700–800° and cooled quickly; H_c increases with time when such a sample is then heated in vacuum at a const. temp. > 200°, and it increases with temp. up to 300°, reaches a max. and then decreases, owing to relaxation. Heating to the Curie point removes the effect of aging; if during cooling the temp. is held const., H_c begins to increase. These effects are due to the creation of large internal stresses during the aging process. For aging below 300°, the temp. dependence of H_c is detd. by the temp. dependence of the satn. magnetostriction. At high temps. the effects of aging and relaxation are irreversible; the relative speeds of these processes dets. the magnitude of H_c at a given temp. and time. Ellen H. Dunlap

INST Physics of Metals, URAL AFFIL, Acad. Sci USSR

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"Influence of Plastic Deformation on the Temperature Relation of the Coercive Force [of Steel, Nickel, and Molybdenum Permalloy]. Ya. S. Shur and K. B. Vlasov (*Doklady Akad. Nauk S.S.S.R.*, 1949, **69**, (5), 647–650). [In Russian]. The causes of the temp. variation of the coercive force are still unknown. S. and V. investigated the influence of cold working on the coercive force of dynamo and transformer steel, nickel, and molybdenum Permalloy. These materials were selected because the temp. relations of the ferromagnetic constants are known only for iron, transformer steel, and nickel. Before the cold working process the materials were annealed in high vacuum. The measurements were carried out *in vacuo* on an astatic magnetometer. The curves H_c/H_{c_0} against temp., i.e. coercive force at test temp. coercive force at room temp., were taken on un-worked specimens and, for iron, with 44 and 75% deformation; for transformer steel, undeformed and with 8, 17, and 55% deformation, and for nickel, cold worked and after various heat treatments. For iron and transformer steel the temp. relation is reversible only up to 250–300° C.; above these temp. the coercive force falls rapidly with time, a clear relaxation phenomenon. There is also a certain critical value of deformation, above which the relative value of the coercive force decreases at temp. higher than room temp. The curve for transformer steel shows a relative minimum at ~380° C. Nickel is particularly sensitive to deformation. Its coercive force has a reversible character in the whole range from −185° to 360° C. (Curie point) for all deformations. Molybdenum Permalloy behaves very similarly to nickel. The paper gives a theoretical expression for the temp. relation based on the "stress theory" and "inclusion theory". B. F. K.

CA

2

Temperature magnetic hysteresis in ferromagnetics II Ya. S. Shur and N. A. Baranova. *Zhur. Eksptl. Teoret. Fiz.* 20, 183-91(1950); *cf. C.A.* 45, 6443h. Expt. results are given of the study of the temp. magnetic hysteresis of Ni and ferrosilicon (3.7% Si), which occurs during cyclic temp. variation (from −195° to the Curie point) in a weak magnetic field. The singularities observed are explained qualitatively by comparing the results with known data on the temp. curves of the anisotropy and magnetostriction consts., and the effect of the thermomagnetic treatment on the temp.-magnetization curves is also shown. To measure the temp. dependence of the magnetization, the sample is cooled to −195° and demagnetized, a const. field is applied, the sample is gradually heated to the max. temp. of the cycle and then cooled to −195°. Graphs are given of the temp. magnetic hysteresis for fields of 0.03 to 30 oersteds; of the relative change of magnetization $\Delta I/I$ after completion of a temp. cycle as a function of the external field; of the temp. magnetization curves $I(t)$ for a max. temp. of the cycle from 250 to 510° for a field of 0.008 oe.; of $I(t)$ for weak fields for a sample previously subjected to fields up to 40 oe. For very weak fields there are subsidiary max. besides the known Hopkinson max. near the Curie point on the heating branches of the $I(t)$ curves, for ferrosilicon max. are observed at about 370, 480° and 580, 600° for fields of 0.03 to 0.09 oe., for Ni, one max. near 100° for fields from 0.30 to 0.45 oe. These max. diminish as the field increases. On the cooling branches a max. occurs at a temp. corresponding to a min. on the heating branch. The heating curves intersect (temp. magnetic hysteresis) only for fields less than 0.01 oe. and for temp. cycles that reach 350–400° for ferrosilicon. As the field increases, the temp. magnetic hysteresis decreases and disappears entirely for a field of 30 oe. for ferrosilicon, 24 oe. for Ni. The thermomagnetic treatment has a great effect on the $I(t)$ curves for ferrosilicon (but it has no effect on those for Ni) in weak fields, and this effect is eliminated only by annealing at a temp. much higher than the Curie temp. $\Delta I/I$ is much greater for Ni than for ferrosilicon, probably because for Ni the anisotropy and magnetostriction consts. decrease more rapidly than for ferrosilicon. The temp. magnetic hysteresis is attributed to changes of magnetic structure during temp. changes, owing to the temp. dependence of the spontaneous magnetization, and to changes of the boundary energy of domains, which depends on the anisotropy and magnetostriction consts. and on internal tensions. E. H. D.

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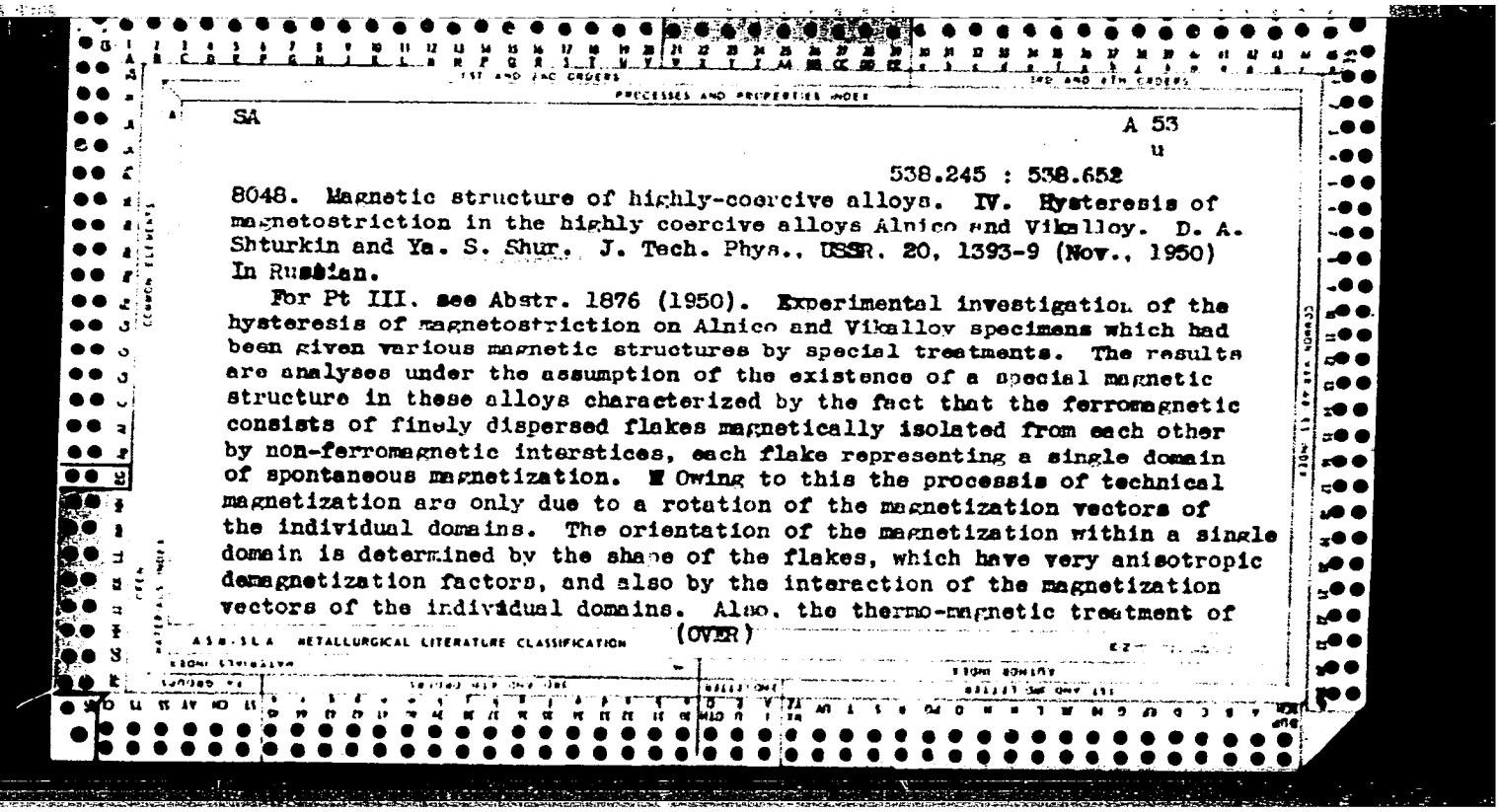

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8048. Magnetic structure of highly-coercive alloys. IV. Hysteresis of magnetostriction in the highly coercive alloys Alnico and Vikalloy. D. A. Shturkin and Ya. S. Shur. J. Tech. Phys., USSR. 20, 1393-9 (Nov., 1950) In Russian.

For Pt III. see Abstr. 1876 (1950). Experimental investigation of the hysteresis of magnetostriction on Alnico and Vikalloy specimens which had been given various magnetic structures by special treatments. The results are analyses under the assumption of the existence of a special magnetic structure in these alloys characterized by the fact that the ferromagnetic consists of finely dispersed flakes magnetically isolated from each other by non-ferromagnetic interstices, each flake representing a single domain of spontaneous magnetization. ■ Owing to this the processis of technical magnetization are only due to a rotation of the magnetization vectors of the individual domains. The orientation of the magnetization within a single domain is determined by the shape of the flakes, which have very anisotropic demagnetization factors, and also by the interaction of the magnetization vectors of the individual domains. Also, the thermo-magnetic treatment of

(OVER)

the Alnico and tempering after stron cold-working of the Vikalloy result in the magnetic flakes growing in an orientated fashion, this accounting for the stron anisotropy of the magnetic properties. B. F. Kraus

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Magnetic texture arising in soft magnetic materials after thermomechanical treatment. Ya. S. Shur and F. N. Dunaev (Cor'ki Ural State Univ., U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* 72, 293-6(1950).—An expt. study was made of the effect of cooling ferro-magnetic alloys from a high temp. while subjected to a single tensile stress, σ_A kg./sq. mm. The texture developed by this thermomech. treatment was detd. by measuring permeability, μ, and magnetostriction, λ, while the specimen was subjected to a single tensile stress, σ kg./sq. mm. Specimens were narrow bands 300 mm. long and 0.4 to 0.6 sq. mm. in area. Three and a half % Si steel cooled from 800° showed a max. μ for σ_A = 1.0 at σ = 0. With increasing σ, μ decreased continuously For σ_A = 0, the value of μ at σ = 0 was a min., but it increased with increasing σ up to σ = 1 and then decreased again. For σ_A = 0 the value of λ was pos. for fields up to 100 oersteds at σ = 0.8 or less. At σ = 2 or more λ was neg. With increasing σ_A, λ tended to be neg., and for σ_A = 1, λ was neg. at least in small fields at all values of σ. Similar results were obtained for 50-permalloy (50% Ni, 1% Mo) cooled from 600°, Cu-permalloy cooled from 500°, and permindur (40% Fe, 49% Co, 2% V) cooled from 700°. Thermomech. treatment causes a preferred orientation of magnetization near the direction of stressing. If this treatment did not cause a change in sign of λ and serious distortion of the cryst. lattice, μ would increase with increasing σ_A. The change in sign of λ seemed decisive in the Si steel, but distortion played a role in the permalloys. Regardless of the Curie temp. value, thermomech. treatment produced a texture. The basic cause of the texture is residual oriented stresses.

A. G. Guy

CA

2

Temperature dependence of the magnetization curves and hysteresis loops of high-coercive alloys. Ya. S. Shur and N. A. Baranova. *Doklady Akad Nauk S.S.S.R.* 74, 225–8(1950). —Samples of Alnico (Fe 51, Co 24, Ni 8, Al 3%) were heated to 1300° and cooled rapidly in fields oriented along and across the axis of the sample, and without a field, and annealed at 600° for several hrs. Samples of Vicalloy (Co 52, Fe 38, V 10%) were subjected to cold deformation by traction (95% reduction) and annealed at 600° for 30 min. Magnetization curves and hysteresis loops were drawn by a vertical astatic magnetometer in the temp. interval −195 to 600°, and the coercive force H_c, the residual induction $4\pi I_r$, and the satn. induction $4\pi I_s$ were drawn as functions of the temp. Temp. increase did not cause a monotonic displacement of the steep part of the magnetization curve for weak fields, and did not cause the coercive force to decrease. This behavior, which differs sharply from that of soft magnetics, was explained by the magnetic structure of these high coercive alloys. The temp. curve of the coercive force was explained qualitatively by assuming that it depends on the form of the insulated domains and their magnetic interaction, i.e., $H_c = NI_s$, where N is the demagnetizing coeff. along the direction in the domain in which it is greatest and I_s is the satn. magnetization. The observed temp. curves of the coercive force were explained by 2 effects: from −195 to 150°, the decrease of the satn. magnetization caused the magnetic interaction to decrease, causing the demagnetizing coeff., and hence the coercive force, to increase. For higher temps., as the temp. increased, the satn. magnetization, and hence the coercive force, decreased. Ellen H. Dunlap

Inst. Physics of Metals, Ural Affil., Acad Sci USSR.

1951

CA

2

Effect of thermomagnetic treatment on the electrical resistance of soft magnetic materials. Yu. S. Shur and I. E. Startseva. *Doklady Akad. Nauk S.S.S.R.* 74, 473-5 (1950); cf. *C.A.* 45, 1931e.—The anisotropy of magnetic properties in some ferromagnetic materials that have been cooled from the Curie point to room temp. in a magnetic field is explained by assuming that the crystal lattice itself is deformed during the thermomagnetic treatment, which leads to magnetic uniaxiality and to the anisotropy of other phys. properties. The relative change of the elec. resistance, $\Delta r/r$, of 68-Permalloy (68% Ni, 34% Fe) after thermomagnetic treatment (heating to 800°, which was maintained for 30 min., then cooling in a magnetic field at 100° per hr.) is given graphically as a function of the longitudinal field, for samples cooled without a field, in a longitudinal, and in a transverse field. The resistances ($\times 10^6$ ohm) of the samples cooled without field, cooled in longitudinal field, and cooled in transverse field, resp., are r 1953, 1950, and 1973; Δr, 16, 8, and 25; r_s, 1969, 1967, and 1998, where r is the elec. resistance of a demagnetized sample, Δr_s is the change in resistance in a magnetic field which brings the sample to satn., $r_s = r + \Delta r_s$ is the total resistance in the field. Since r_s is not const. for various treatment, the assumption is confirmed, but the anisotropy in the curves $\Delta r, r(H)$ is due to the magnetic texture produced by thermomagnetic treatment.

Ellen H. Dunlap

CA.

9

Dependence of the coercive force of powders of high-coercive alloys on the grain size. T. D. Zotov and Ya. S. Shur. *Doklady Akad. Nauk S.S.S.R.* 74, 687–90(1950).—Powders of AlNi (25% Ni, 14% Al, remainder Fe) were prepd. in two ways: (1) Cold-hardened powders by crushing ingots which had already undergone a thermal treatment leading to max. H_c; (2) Ingots were crushed and then treated thermally. Graphs of the coercive force H_c as a function of the diam. d of the powder particles show that H_c decreases rapidly for $d < 100\ \mu$ for cold-hardened powders and for annealed powders of crushed tempered ingots. This effect is explained by assuming that cold-hardening alters the magnetic structure and that plastic deformation tends further to break up the supersatd. solid soln. of the initial high temp. phase. $H_c(d)$ is const. for values of d from 25 to 700 μ if the ingots are first crushed, then heated to the temp. of solid soln., and then annealed for 30 min. at const. temp. (675–775°), or if the prepd. powders are cooled with optimum rapidity. Then the thermal treatment produces uniform structural changes throughout the vol. of the powder particles.

Ellen H. Dunlap

USSR/Metals - Coercive Force, Steel's Jan 51

"Temperature Dependence of the Coercive Force in Monocrystals of Transformer Steel," K. B. Vlasov, Ya. S. Shur, Lab Ferromagnetics, Inst Phys of Metals, Ural Affil, Acad Sci USSR

"Zhur Tekh Fiz" Vol XXI, No 1, pp 39-50

Results of measurements of temp behavior of coercive force in monocrystallic disks of transformer steel: Shows temp behavior of coercive force depends on crystallographic direction along which

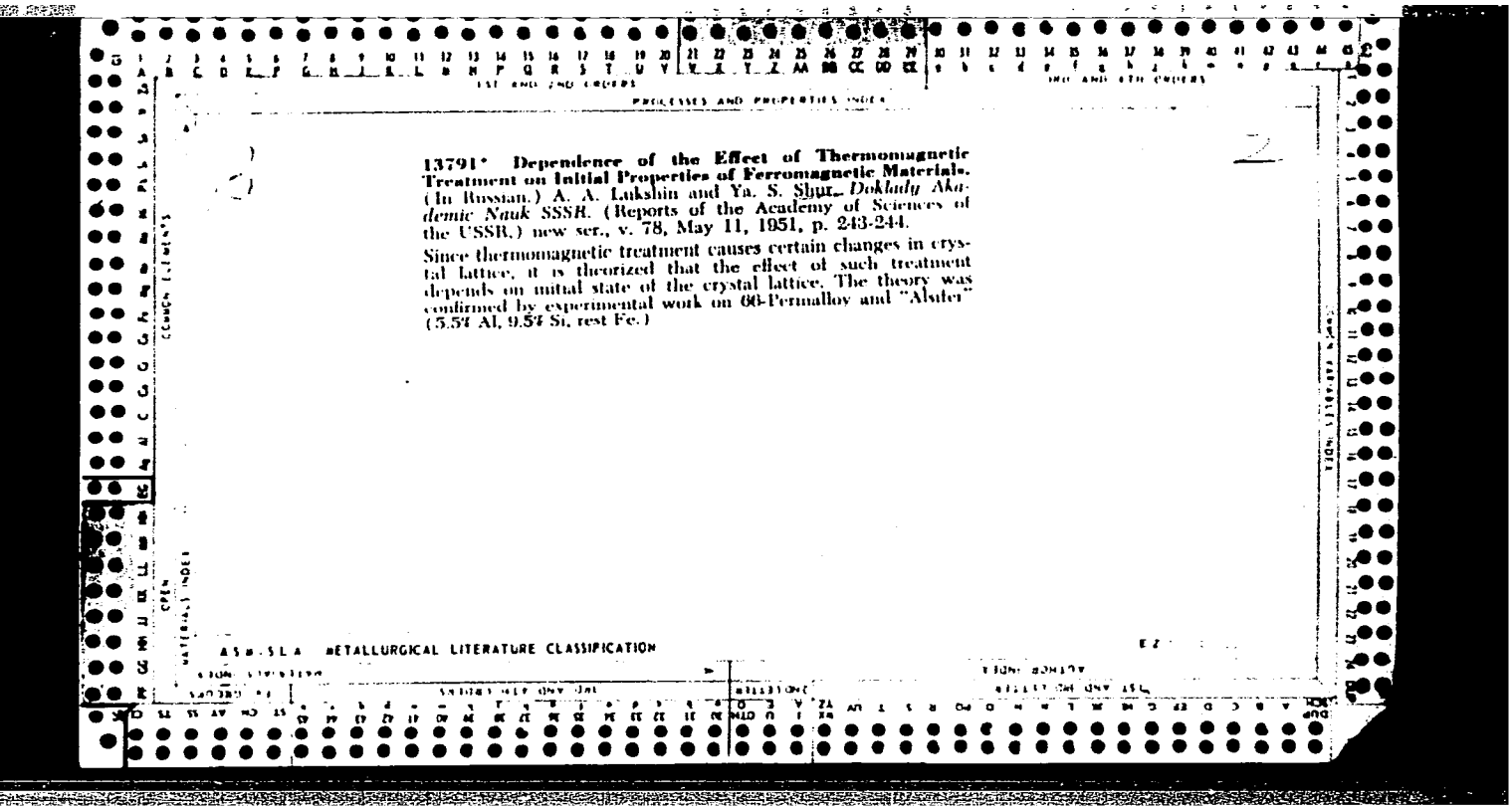
174T41

USSR/Metals - Coercive Force, Steel's (Contd) Jan 51

measurements are conducted. Analyzes exptl laws obtained on basis of theory of magnetization curves used in eng. Submitted [illegible] Oct 49.

174T41

SHUR, Ya. S.



13791* **Dependence of the Effect of Thermomagnetic Treatment on Initial Properties of Ferromagnetic Materials.** (In Russian.) A. A. Lukshin and Ya. S. Shur. *Doklady Akademic Nauk SSSR.* (Reports of the Academy of Sciences of the USSR.) new ser., v. 78, May 11, 1951, p. 243-244.

Since thermomagnetic treatment causes certain changes in crystal lattice, it is theorized that the effect of such treatment depends on initial state of the crystal lattice. The theory was confirmed by experimental work on 66-Permalloy and "Alsifer" (5.5% Al, 9.5% Si, rest Fe.)

USSR

The relation of the coercive force to the dimensions of the particles for powders of soft magnetic materials. Ya. S. Shur, T. D. Zotov, and I. A. Chebotarev. *Doklady Akad. Nauk S.S.S.R.* 81, 387–9(1951).—The effect of the particle dimensions and of voltage and temp. on the coercive force, H_c, was studied with the alloy alsifer (compn., 9.4% Si, 5.3% Al, 85.3% Fe). For powders that were not annealed there was a linear increase in H_c with decreasing diam. of the particle. For particles of diam. $< 50\ \mu$, the increase is much sharper. For annealed particles, H_c remains almost const. for diam. $> 50\ \mu$ but a steep increase is observed for diam. $< 50\ \mu$. The temp. curves for H_c are given for samples of various particle sizes. For particle sizes $> 23\ \mu$ a min. occurs as the temp. is varied from −200 to 300°.

J. Roytar Leach

INST. Physics of Metals URAL AFFIL. Acad. Sci USSR.

Magnetism

SA
Sect. A

538.23

5988. **Temperature-magnetic hysteresis in highly coercive alloys.** YA. S. SHUR, N. A. BARANOVA AND V. A. ZAIKOVA. *Doklady Akad. Nauk SSSR*, 81, 557–69 (*No.* 4, 1951) *In Russian.*

Cylindrical rods (length 48 mm, dia. 2·7 mm) of Alniko (an alloy composed of 51% Fe, 24% Co, 14% Ni, 8% Al and 3% Cu) were treated as follows: (*a*) heating to 1300°c followed by cooling in either a longitudinal or transverse magnetic field; (*b*) annealing at 600°c for several hours. After such treatment samples cooled in longitudinal and transverse fields had coercive strengths of 550 and 250 oersteds respectively. Measurements of the temp.-magnetic hysteresis were made over a temp. range of − 195° to 550°c in a constant, magnetic field from 3 to 360 oersteds. Results given graphically showed that for samples treated in the longitudinal magnetic field, even at field strengths as low as 3 oersteds, there was a considerable temp.-magnetic hysteresis, which disappeared when the field strength reached 360 oersteds. For samples treated in a transverse magnetic field, the effect was not manifest till 12 oersteds and disappeared at 120 oersteds; in addition the absolute value of the hysteresis was considerably smaller than for the longitudinal magnetic fields. W. HUGHES

INST. Physics of Metals, URAL AFFIL. Acad. Sci USSR

S'UR, Ya. S. and VONSOVSKIY, S. V.

"Ferromagnetism," Glavpoligrafizdat, Main Polygraphic Publishing House, 816 pp, 1952

SHUR, Ya.S.; MISHIN, D.D.

Effect of weak elastic stresses on the initial susceptibility of ferromagnetics. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 16, 634-9 '52. (MLRA 6:3)
(CA 47 no.20:10296 '53)

Attempts to obtain experimentally detailed data showing dependence of magnetic properties in weak fields on elastic tensions. Results agree with Vonsovskiy's theory (ZhETF, 17, 1947); (Ferromagnetism, 1948).

251T28

LUKSHIN, A.A.; SHUR, Ya.S.

Dependence of the effect of thermomagnetic treatment on the initial properties of the ferromagnetic material. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 16, 647-52 '52. (MLRA 6:3)
(CA 47 no.20:10295 '53)

SHUR, YA. S., DUNAYE , F. N.

Thermomagnetism

Effect of thermomechanical treatment of soft magnetic materials as a function of the size of the load and the treatment temperature. Izv. AN SSSR Ser. fiz. 16, No. 6, '52.

Thermomechanical treatment of ferromagnetics, and of transformer steel (3.7% Si, remainder Fe) and 65 permalloy (65% Ni, remainder Fe) is studied. Results are plotted in curves, which show optimal temp for steel to be 600° C and for permalloy, 450° C. 251T39

Monthly List of Russian Accessions, Library of Congress June 1953. UNCL.

SHUR, Ya. S.

235T100

USSR/Physics - Gol'dgammer-Thomson Effect
Transformer Steel

Sep 52

"Change in the Electric Resistance of Monocrystals of Transformer Steel in a Magnetic Field," T. D. Zotov, Ya. S. Shur, Inst of Phys of Metals, Ural Affiliate, Acad Sci USSR

"Dok Ak Nauk SSSR" Vol 86, No 2, pp 267-270

Gol'dgammer found that the elec resistance of a ferromagnetic increased in a longitudinal magnetic field and decreased in a transverse field. It was found recently that resistance of some ferromagnetics decreases in both types of fields.

235T100

Describes exptl study of this effect in monocrystals of transformer steel (3.5% Si). Submitted by Acad I. P. Bardin 16 Jul 52.

(CA 47 no. 17:8433 '53)

235T100

SHUR, Ya. S.

"Effect of Small Elastic Stresses on Initial Susceptibility of Ferromagnetics," Ya. S. Shur and D. D. Mishin, Ural State U. Dok AN SSSR, Vol 87, No.4, pp 543-46, Dec 1952.

Investigate experimentally dependence of magnetic properties in weak fields upon weak elastic stresses in a number of ferromagnetic materials of various magnetic structure, internal stresses, crystallographic directions. Established the governing rules. Compare results and find them in agreement with those of S. B. Vonsovskiy (see ZhETF, 17, 1947). Presented by Acad N. A, Leontovich 11 Feb 52. 256T110

Shur, Ya. S.

TRUDY INSTITUTA FIZIKI METALLOV, AKAD. NAUK. URALSKII, FILIAL, 1954, NO. 15 MSG

Temperature dependence of magnetisation curves and hysteresis loops of Alnico and Vicalloy alloys by Ya. S. Shur and N. A. Baranova (p. 19-28) - Measurements were made in the range -195° to 600°C with the aim of confirming the deductions following from the thin-plate model of these materials. A mechanism is proposed which explains qualitatively the shape of the experimental curves.

Df 9(1)

Shur, Ya. S.

TRUDY INSTITUTA FIZIKI METALLOV, AKAD. NAUK. URALSKII FILIAL, 1954 No. 15 MG

On the magnetic texture of soft magnetic materials after thermo-mechanical treatment by Ya. S. Shur and F. N. Dunaev (p. 20-44) - Textures produced in 300 mm long, 0.4 - 0.6 mm^2 cross-section area specimens of 3.5% Si iron, 56 Permalloy, Cu-Permalloy and V-Permindur on cooling from 600°, 600°, 500°, and 700°C respectively to room temperature with simultaneous application of a range of tensile loads are investigated.

Sf gw (1)

SHUR, YA.S.

4

*Dependence of the Coercive Force of Soft Magnetic Materials on the Thickness of Foils. V. A. Zaikova and Ya. S. Shur (*Doklady Akad. Nauk S.S.S.R.*, 1954, 94, (4), [illegible] (In Russian). The coercive force, H_c, of foils prepared from 12 soft magnetic materials was determined as a function of the foil thickness in the range 0·5–0·002 mm. The foils, carefully prepared and annealed, were mounted inside thin quartz tubes in order to prevent changes of thickness and deformation during measurement. The materials tested included Fe, Ni, Fe–Ni alloys contg. 36–87% Ni (Permalloy, Hyperm, Hypernik, &c.), and Fe–Si alloys contg. 1–4% Si. The relation between H_c and the foil thickness was of the same character for all materials examined. In the range 0·1–0·07 mm., values of H_c for the foils remained practically const. and equal to H_c for massive specimens. At a certain critical thickness, H_c began to increase very rapidly, reaching, at a thickness of the order of 10^{-3} mm., values ~10 times greater than the value for massive specimens. The relative increase of H_c was greatest for alloys with small values of the const. of anisotropy and magnetostriction. The change in H_c with thickness was attributed to the changes of magnetic structure of the materials and the increasing importance of the surface domains.—S. K. L.

INST. Physics of Metals, Ural AFFIL, Acad Sci USSR

S/11-R, Ya, 5,

USSR

On the Processes of Magnetisation Conditioning the Phenomenon of Temperature Magnetic Hysteresis in Ferromagnetics

Dokl.Akad.Nauk 94(5),825-827 1954

N.A. Baranova, Ya. S. Shur U.S.S.R.

Temperature magnetic hysteresis was studied on nickel wires 100 mm. long and 0,3 mm. in dia. Temperature changed in the interval of -195 to +20 deg.C. in constant magnetic field of 6, 12, 23, 35, 47 and 59 oersted. It has been established that temperature magnetic hysteresis appeared in test pieces of nickel subjected to elastic tension only when the process of displacement took place. It would disappear if only rotation processes were present. (Bibl.4)

USSR .

Anisotropy of the magnetic properties in powder specimens of MnBi alloy. E. V. Shtol'ts and Ya. S. Shur. *Doklady Akad. Nauk S.S.S.R.* 95, 781–4(1954).—Expts. were made on alloys prepd. by sintering Mn and Bi at 550°. These alloys contained 30 vol. % of the ferromagnetic MnBi phase and the balance free Mn and Bi, the satn. magnetization was 2400 gausses, and the coercive force, H_c, was 80 oersteds. The alloys were powdered mechanically and fractions from 1.2 mm. to 3 μ in diam. were obtained. Magnetic structure was created in the specimens by mixing powder of a given size with bakelite varnish and drying between the poles of an electromagnet. Parallel, ||, textures were obtained by having the magnetic field along the specimen axis, and transverse, $\perp$, textures by having the magnetic field perpendicular to the axis. Specimens with no, 0, texture were prepd. by drying in the absence of a field. Magnetic properties were detd. by a ballistic method at −195 and +20°. Specimens with 0 texture showed a continuous increase in H_c at 20° from 500 to 5600 with decrease in particle size from 250 to 3 μ. Specimens with 3-μ particles had H_c values at 20° of 9000 and 1600 for || and $\perp$ textures, resp. The ratio I_r/I_s of the residual magnetization to the satn. magnetization was 0.93 for the || texture, 0.61 for 0 texture and 0.15 for the $\perp$ texture. A plot of H_c *vs.* particle diam. showed a sharp increase in H_c at diams. below about 10μ, for || and 0 textures and a slight decrease below 7μ for $\perp$ textures. At −195° H_c and I_r/I_s were low and there was little effect of particle size or of texture. The results at 20° showed that the finer particles approached a one-domain structure. The decrease in H_c at −195° showed that magnetic anisotropy is needed for high H_c. A. G. G.

Inst. Physics of Metals, Ural Affil., Acad Sci. USSR.

Shur, Ya. S.

Investigation of the magnetic structure of the crystals of siliceous iron by the method of powder figures. Ya. S. Shur and V. R. Abel's. *Fiz. Metal. i Metalloved., Akad. Nauk S.S.S.R., Ural. Filial.* 1, No. 1, 5-10(1955); *Doklady Akad. Nauk S.S.S.R.* 104, 209-10(1955); cf. *C.A.* 50, 2224g; 8423h.—The investigation was made by methods used in the previous investigation of subareas. The material studied was steel contg. 4% Si. The orientation of the individual crystallites was established by x-rays with accuracy to ±2°. Evaluation of the results indicates that the magnetic structure of the surface areas of crystals is wholly controlled by the crystallographic orientation. The main areas are always assocd. with enclosed areas that produce a decrease of the magnetostatic energies of the systems. If the surface of the sample coincides with the planes (001) or (011), the enclosed areas appear only at the end of the main areas. The shapes of the enclosed areas vary strongly, depending on the crystallographic orientation of the surface areas of the sample. The most common types are droplets, dendrites, and combs. The magnetization vectors of the enclosed areas are oriented downwardly at the smallest possible angles to the surface. Cf. following abstr.

M. O. Holowaty

INST. Physics of Metals, URAL AFFIL, Acad. Sci USSR AND URAL State Univ. im. GOR'KIY

Shur, Ya. S.

Investigation of domains on crystals of siliceous iron by the method of powder figures. Ya. S. Shur and V. R. Abel's. *Fiz. Metal. i. Metalloved., Akad. Nauk S.S.R., Ural. Filial* 1, No. 1, 11–17(1955).—The study was conducted on coarsely grained samples of steel strip contg. 4% Si. The av. thickness of the samples ranged from 0.2 to 0.5 mm., while the over-all lengths of individual crystallites were 1–5 mm. The sample disks of steel measuring to approx. 10 mm. in diam. were polished first mechanically and then electrolytically to remove eventual deformations. Magnetic suspension was prepd. according to the method of Elmore (*C.A.* 32, 7709[4]). The magnetization of the sample was attained by two selenoids located on the same axis approx. 80 mm. apart. The resulting figures were photographed under 70–150 × magnification. The results showed: (1) the domains in the vicinity of a single defect were always in the form of a dagger (where located between several defects they attained shape of rectangulars); (2) the domains of several defects such as voids, inclusions, and destruction of cryst. structure are products of blending of several specific areas created by the magnetic poles centering in the points of defects. M. O. Holowatv

(2)

Inst. Physics of Metals, Ural Affil. AS USSR

SHUR, Ya.S.; ZAYKOVA, V.A.

Relation of the coercive force to the thickness of sheets made of magnetic materials. Fiz.met.i metalloved. 1 no.1:18-27 '55. (MLRA 9:3)

1. Institut fiziki metallov Ural'skogo filiala Akademii nauk SSSR.
(Magnetic materials) (Ferromagnetism)

SHUR, Ya.S.

FIZ. MET. I METALL. VOL 1, NO. 1, 1955

Thermomagnetic treatment of soft magnetic materials in fields of various intensities by A. A. Lukshin and Ya. S. Shur (p. 28-35) - Anisotropy of magnetic properties resulting from cooling in magnetic fields of various strength is studied on samples of silicon iron and Permalloy 66. Empirical relations are derived. Magnetic textures produced by thermomagnetic treatment are interpreted on the basis of magnetization and magnetostriction curves.

SHUR, Ya.S.; BARANOVA, N.A.

Temperature dependence of the magnetization curves and histeresis loop of Alnico and "Vikalloy" alloys. Trudy Inst. fiz. met. no.15: 19-28 '55. (MLRA 8:6)

(Magnetic materials)

SHUR, Ya.S.; DUNAYEV, F.N.

Magnetic texture formed in soft magnetic materials following heat and mechanical treatment. Trudy Inst. fiz. met. no.15: 29-41 '55. (MLRA 8:6)

(Magnetic materials)

DROZHZHINA,V.I.; LUZHINSKAYA,M.G.; MOROZOVA,V.M.; SHUR,Ya.S.

Effect of magnetic texture of ferromagnetic materials on the trend in the modifications of electric resistance curves in the magnetic field. Trudy Inst. fiz. met. no.15:42-56 '55. (MLRA 8:6)
(Ferromagnetism)

SHUR, YA. S.

USSR/ Physics - Crystallography

Card 1/1 Pub. 22 - 21/62

Authors : Shur, Ya. S., and Abel's V. R.

Title : Study of the "sub-regions" by the method of powdered figures applied to ferrosilicon crystals

Periodical : Dok. AN SSSR 102/3, 499 - 501, May 21, 1955

Abstract : The results of experiments conducted for the purpose of studying the conditions under which the so-called "sub-regions" formed in ferrosilicon crystals and their (sub-regions) effect on the process of technical magnetization are described. Six references: 2 USSR, 1 French, 3 USA (1938-1953). Illustrations.

Institution : The Acad. of Sc., Ural Branch, Institute of the Physics of Metals

Presented by: Academician A. I. Kikoin, February 5, 1955

Shur, Ya. S.

538.221 824

Investigation by Powder-Pattern Method of the Magnetic Structure of Silicon-Iron Crystals.—Ya. S. Shur & V. R. Abel's. (*C. R. Acad. Sci. U.R.S.S.*, 11th Sept. 1935, Vol. 104, No. 2, pp. 209–210. In Russian.) From the photographs shown, general relations are deduced of the dependence of magnetic structure on the crystallographic orientation of the specimen surface.

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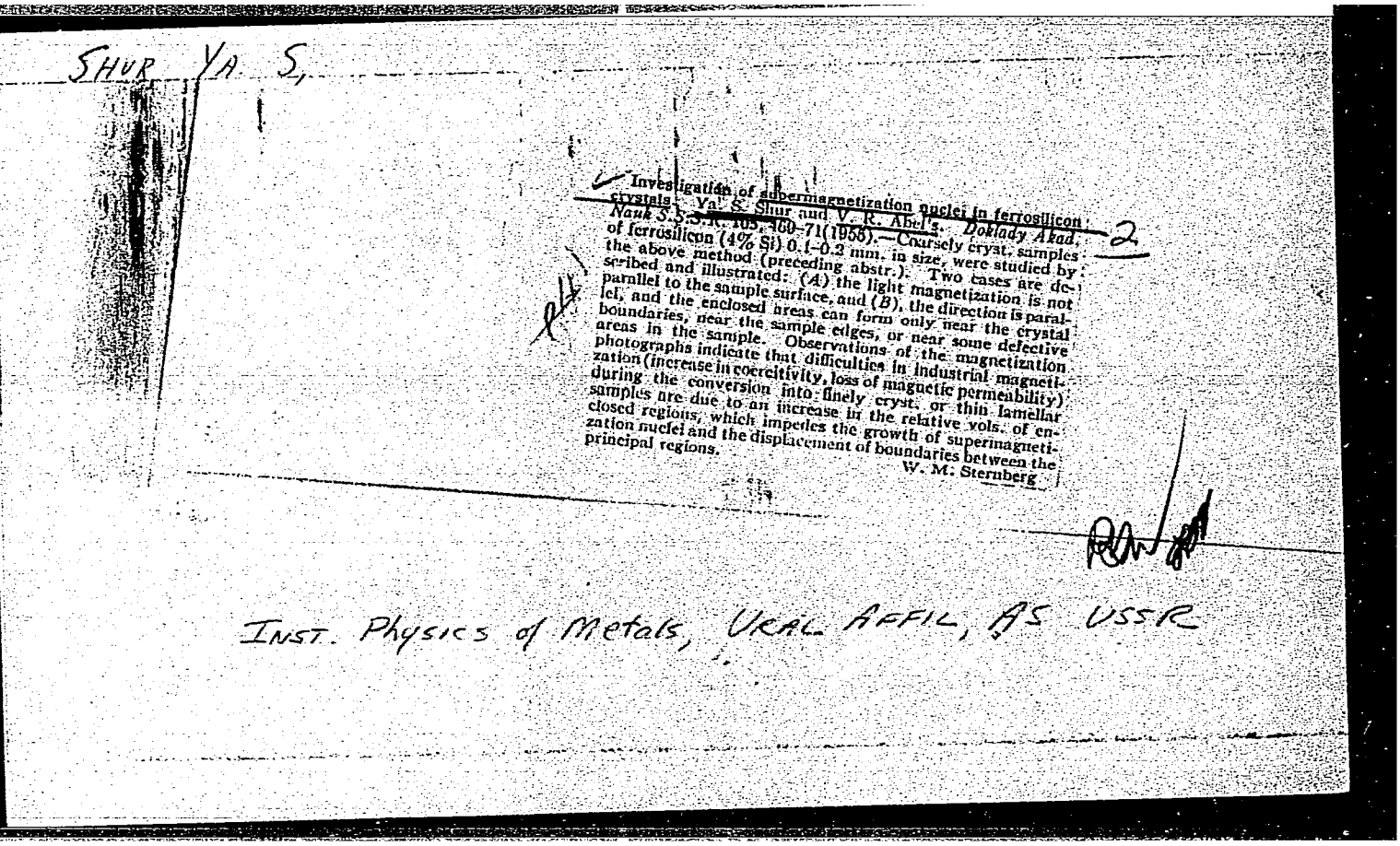
INST. Physics of Metals, URAL AFFIL, AS USSR



SHUR YA S,

Investigation of supermagnetization nuclei in ferrosilicon crystals. Ya. S. Shur and V. R. Abel's. *Doklady Akad. Nauk S.S.S.R.* 105, 469–71 (1958).—Coarsely cryst. samples of ferrosilicon (4% Si) 0.1–0.2 mm. in size, were studied by the above method (preceding abstr.). Two cases are described and illustrated: (*A*) the light magnetization is not parallel to the sample surface, and (*B*), the direction is parallel, and the enclosed areas can form only near the crystal boundaries, near the sample edges, or near some defective areas in the sample. Observations of the magnetization photographs indicate that difficulties in industrial magnetization (increase in coercitivity, loss of magnetic permeability) during the conversion into finely cryst. or thin lamellar samples are due to an increase in the relative vols. of enclosed regions, which impedes the growth of supermagnetization nuclei and the displacement of boundaries between the principal regions.

W. M. Sternberg

INST. Physics of Metals, URAL AFFIL, AS USSR

SHUR, Ya. S. and STARTSEVA, M. E. (Sverdlovsk)

"Stability of magnetic structure of Residual-Magnetized Soft magnetic Materials," paper submitted at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, USSR, 23-31 May 1956

SHUR, Y. S. and ABELS, V. E. (Sverdlovsk)

"Investigation on the Magnetic Structure of silicon-Iron Crystals by Means of Powder Patterns," paper presented at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, USSR, 23-31 May 1956

SHUR, Y. S. , STOLTS, E. V. and KANDUROVA, G. S. (Sverdlovsk)

"Magnetic Properties of Magnetic Oriented Powder Specimens with High Coercivity," paper presented at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, USSR, 23-31 May 1956

SHUR, Ya. S.

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"The Influence of Elastic Stresses and Thermomechanical Treatment on the Magnetic Properties of High-Coercivity [Iron-Base] Alloys. Ya. S. Shur, M. G. Luzhinskaya, and L. A. Shubina (*Fizika Metallov i Metallovedenie*, 1956, 2, (3), 567–568).—[In Russian]. A letter. Experiments on Fe–Co–W and Fe–Mn alloys show that: small stresses do not change the relative proportions of ferromagnetic and non-ferromagnetic phases; their only effect is to increase the anisotropy in individual domains, i.e. to increase H_c (coercive field). At the same time small stresses improve the magnetic texture, i.e. increase B_r (remanent magnetization). Large stresses convert ferromagnetic phases into non-ferromagnetic,

i.e. reduce H_c and B_r. As an example of the use of thermo-mech. treatment S. *et al.* quote the improvement of H_c from 400–450 Oe. before treatment to 500–550 Oe. after, and of $(BH)_{max.}$ from 2–3 before to 3–4 × 10^6 gauss.Oe. after. The best magnets improved by this process have $H_c = 570$ Oe., $(BH)_{max.} = 4{\cdot}2 \times 10^6$ gauss.Oe. and $B_r = 10{\cdot}4$ k.gauss.

—A. F. B.

USSR / Magnetism . Ferromagnetism F - 4

Abs. Jour : Ref Zhur - Fizika, No 4, 1957, No 9534

Author : Startseva, I.E., Shur, Ya. S.
Inst : Institute of Physics of Metals, Ural' Branch, Academy of Sciences USSR, Sverdlovsk.
Title : Residual Magnetization of Nickel and Its Stability.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 2, No 3, 568

Abstract : A study was made of the influence of the preliminary treatment (recrystallizing annealing, oxidizing annealing, and plastic deformation by tension or compression) on the value of I_r of nickel and its stability against alternating magnetic fields, mechanical vibrations, and temperature fluctuations. It was observed that treatment of the material (even such treatment that does not lead to the creation of a crystalline or magnetic texture) can change radically both the value of I_r as well as its ability. In this case the stability of I_r can both increase and decrease with increasing H_c.

Card : 1/1

Shur, Ya. S.

USSR/Magnetism - Ferromagnetism F-4

Abs Jour : Referat Zhur - Fizika, No 5, 1957, 12003

Author : Startseva, I.Ye., Shur, Ya.S.
Inst : -
Title : Change of the Magnetic State of Soft Magnetic Materials Under the Influence of Alternating Magnetic Fields.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 3, No 1, 190-191

Abstract : Report on a study of the variation in the value of I_r of annular specimens of nickel and permindure under the influence of alternating magnetic fields having an amplitude that diminishes smoothly to zero. It is shown that such an alternating field cannot only demagnetize a residually-magnetized specimen, but in some cases it can increase the I_r of the specimen, and also change the sign of I_r.

Card 1/1

Shur, Ya. S.

F-4

Abs Jour : Referat Zhur - Fizika, No 5, 1957, 12006

Author : Shur, Ya.S., Kandaurova, G.S., Shtol'ts, Ye.V., Bulatova, L.V.

Inst : Institute of Physics of Metals, Ural' Branch, Academy of Sciences, USSR, Sverdlovsk.

Title : Investigation of Magnetization Processes in a High-Coercive MnBi Alloy by Means of Powder Patterns.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 3, No 1, 191-192

Abstract : The magnetic structure of the MnBi alloy and its variation in the magnetic field were studied. The specimens had $H_c \sim 1{,}000$ oersted and consisted of individual particles of a MnBi alloy measuring ~ 15 -- 20 microns, insulated by layers of Bi. In certain crystals there were observed on a plane parallel to the hexagonal axis

Card 1/2

SHUR, Va. S.

18 4E2 c-1 4

Relation between the magnetic structure of silicon steel crystals and their thickness. V. R. Abel's and Va. S. Shur. *Fiz. Metal. i Metalloved.* 3, 433–8(1956).—Disks of monocryst. or coarsely cryst. 4% Si steel 20–100 sq. mm. in area and 0.10–0.24 mm. thick were reduced in thickness, in steps, by electrolytic polishing down to 5 μ. Their cryst. orientation was detd. with x-rays and magnetic characteristics by powder figures. When the direction of easiest magnetization formed with the (100) surface of steel an angle of about 1°, the magnetic structure consisted basically of areas developed by 180° boundaries. With a greater deviation, these basic areas were supplemented with fir-shaped or comb-shaped areas joining the former, or even more complex ones.
—I. D. Gat

SHUR, Ya.S.

GLAZER, A.A.; SHUR, Ya.S.

Effect of thermomagnetic treatment and ordering processes. Fiz. met. i metalloved. 3 no.3:568-569 '56. (MIRA 10:3)

1. Institut fiziki metallov Ural'skogo filiala AN SSSR.
(Thermomagnetism) (Ferromagnetism)

Shur, Ya. S. 108

AUTHOR: Shur, Ya. S., Luzhinskaya, M.G. and Shubina, L.A.

TITLE: Influence of elastic stresses on the magnetic properties of Vicalloy. (Vliyaniye uprugikh napryazheniy na magnitnye svoystva splava vikalloy.)

PERIODICAL: "Fizika Metallov i Metallovedenie" (Physics of Metals and Metallurgy), 1957, Vol.IV, No.1 (10), pp. 54-59, (U.S.S.R.)

ABSTRACT: The influence of unilateral elastic stretching and elastic torsion on the magnetic properties of the high coercitivity Vicalloy (12% V, 52% Co, rest Fe) was investigated on wire specimens. It was experimentally established that elastic stresses have a considerable influence on the magnetic properties of Vicalloy. Elastic stretching leads to an increase of H_c to several times the original value and also to an increase of B_r. In the case of elastic torsion H_c also increases but B_r decreases. It is shown that the increase in H_c both for stretching and torsion is caused by an increase in the anisotropy of the single domain formations due to the increase of the anisotropy of the stresses. Change of the residual induction in the case of stretching is due to an increase in the longitudinal magnetic texture and in the case of torsion it is due to a weakening of the texture. The results obtained confirm that the high coercive forces of coercive alloys are due to large magnetic anisotropies in presence of a single domain structure. 6 graphs, 5 references, 1 of which is Russian.

Institute of Metal Physics, Ural Branch of the Ac.Sc. Recd. August 3, 1956.

SHUR, Ya. S.

18 18 1-7-

12005* (Russian.) Hot Working of Vicalloy. Termonekhanicheskaia obrabotka splava vikallot. Ia. S. Shur, M. G. Luzhinskaia, and L. A. Shubina. *Fizika Metalloo i Metallovedenie*, v. 4, no. 1, 1957, p. 60-69.

Study of the effect of hot working on highly coercive alloys. The alloy tested contained 52% Co, 12% V, and the balance Fe. The samples consisted of cold-drawn wires of 0.1 to 3.0 mm. dia.

RG

AUTHORS: Luzhinskaya, M. G. and Shur, Ya. S. 126-2-9/30

TITLE: The effect of elastic stresses and thermo-mechanical treatment on the magnetic properties of some solid magnetic materials. (Vliyaniye uprugikh napryazheniy i termomekhanicheskoy obrabotki na magnitnye svoystva nekotorykh zhestkikh magnitnykh materialov).

PERIODICAL: "Fizika Metallov i Metallovedeniye" (Physics of Metals and Metallurgy), Vol.IV, No.2, 1957, pp.239-244 (USSR)

ABSTRACT: In previous papers (1 and 2) the authors have shown that elastic stress and thermo-mechanical treatment have a real effect on the magnetic properties of materials with high coercivity. Results are now reported on the effect of elastic stress, torsion, and thermo-mechanical treatment on the magnetic properties of the following alloys: (8% V, 52% Co, 40% Fe), (14% V, 52% Co, 34% Fe), and (15% Mn, 85% Fe). The thermo-mechanical treatment consisted in the application of one-sided tensile stress during tempering. Experimental details were given in earlier work (1 and 2). The effect of the above mentioned factors on the magnetic properties of the Fe-Co-V alloys, and the alloy (12% V, 52% Co, 36% Fe) which was investigated earlier, turned out to be of the same character in all the cases

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F-2

S/ U.R., Ya. S.

USSR/Magnetism - Ferromagnetism

Abs Jour : Ref Zhur - Fizika, No 1, 1958, 1153

Author : Luzhinskaya, M.G., Shur, Ya.S.

Inst : Institute of Physics of Metals, Ural' Branch, Academy of Sciences, USSR, Sverdlovsk.

Title : Effect of Elastic Stresses and Thermal-Mechanical Working on Magnetic Properties of Certain Rigid Megnetic Materials

Orig Pub : Fiz. metallov i metallovedeniye, 1957, 4, No 2, 239-244

Abstract : An investigation was made of the influence of elastic tension and torsion and also thermal-mechanical working, on the magnetic properties of alloys of the following composition: 8% V, 50% Co, remainder Fe; 14% D, 52% Co, remainder Fe; and 15% Mn, remainder Fe. The thermal-mechanical working consists of superimposing unilateral tension stresses on specimens during the time of their tempering,

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USSR/Magnetism - Ferromagnetism F-2

Abs Jour : Ref Zhur - Fizika, No 1, 1958, 1153

leading to the development of a high-coercivity state. It was established, that the above effects cause a change in the magnetic properties of these alloys, thanks to the change in the magnetic anisotropy and the magnetic texture.

Card 2/2

On the Domain Structure of the High Coercitivity Manganese-Bismuth Alloy.

important to observe directly the domain structure and its changes caused by the effect of a magnetic field and for this purpose the authors carried out the here described investigations for studying the domain structure of the high coercitivity alloy manganese-bismuth, using the powder pattern method. The Mn-Bi alloy was selected for the experiments because it has the highest magnetic anisotropy energy; when crushed into finer particles the coercive force in particles of the order of 10 to 20μ reaches up to 5000 Oe and it can be assumed that,as a result of the high value of the magnetic anisotropy constant, such comparatively large particles will have either a single domain or a nearly single domain magnetic structure,which can be detected by powder patterns. Attempts to study the domain structure were made by various authors (Ref.4) but the results did not allow any definite conclusions on the domain structure of the high coercive alloys and particularly on the magnetization process itself. The experiments were made on cylindrical specimens, 6 mm dia., 10 mm long produced by sintering in vacuum of manganese and bismuth powders at 300°C for one hour. It was established microscopically that after such

On the Domain Structure of the High Coercitivity Manganese-Bismuth Alloy.

sintering the specimen consists of formations of the manganese-bismuth compound with dimensions of 15 to 20μ separated by interlayers of bismuth and manganese; the specimens had a coercive force of the order of 1000 Oe. The results are described and the powder patterns are reproduced in a number of photographs. These show that in a manganese-bismuth alloy consisting of MnBi crystallites of sizes of 15 to 25μ and separated from each other by non-ferromagnetic interlayers, the process of remagnetization parallel to the axis of the easiest magnetization can proceed in the following two ways: by the formation of nuclei, their growth and transformation of some of these in the range of reversible magnetization and a displacement of 180° boundaries between the individual areas, whereby a coercive force of 1000 Oe can be achieved; solely by rotation which is achieved if the magnetizing force is adequate for anihilating the remagnetization nuclei, which excludes occurrence of closing areas, and in this case the coercive force can reach several thousand Oe. Apparently the revealed features are due to the fact that the dimensions in the investigated crystallites are near to the critical size

SHUR, YA. S

126-2-21/22

AUTHORS: Shur, Ya. S., and Glazer, A. A.

TITLE: Thermomagnetic treatment and processes of ordering. (Termomagnitnaya obrabotka i protsessy uporyadocheniya.) Part. I. On the relation between the effect of thermomagnetic treatment and the processes of ordering. (I. O svyazi effekta termomagnitnoy obrabotki s protsessami uporyadocheniya).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2, pp. 355-360 (USSR)

ABSTRACT: A number of assumptions have been expressed on the existence of an inter-relation between the effect of thermomagnetic treatment and the phenomenon of ordering. However, there are no experimental data confirming that such a relation does exist. Therefore, from the point of view of thermomagnetic treatment it is of great interest to study the effect in ordering alloys for the purpose of establishing a relation between the mechanism of thermomagnetic treatment and the phenomenon of ordering. For solving this problem the temperature range was determined for several ferromagnetic alloys in which thermomagnetic treatment is effective and also the influence of this treatment on the temperature dependence

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problems was governed by the following considerations: if the ordering processes play an important role in the mechanism of thermomagnetic treatment, this treatment can be effective only at temperatures below the critical ordering temperature T_c; literary data on this problem are scarce and contradictory. If thermomagnetic treatment does lead to a new structural state in the temperature characteristic of the saturation magnetization. The authors investigated the following ferromagnetics: 66-permalloy (66% Ni, 34% Fe) and perminvar (34% Ni, 29% Co, 34% Fe, 3% Mo), which are most intensively affected by thermomagnetic treatment; 78-permalloy for which the processes of ordering have been most fully studied. Furthermore, the permendur (49% Co, 49% Fe, 2% V) was studied, an alloy characterized by a high Curie point and a high critical ordering temperature and also an iron-aluminum alloy containing 12% Al. For judging the effectiveness of the thermo-

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Thermomagnetic treatment and processes of ordering. 126-2-21/35
Part 1. On the relation between the effect of thermomagnetic treatment and the processes of ordering.

magnetic treatment the saturation magnetostriction λ_s and the coercive force H_c were measured, on the basis of which it is possible to evaluate the magnetic texture. The specimens were in the form of strips of 60 x 4 x 0.2 mm^3. The ordering was effected by annealing for 100 hours at a temperature slightly below T_c, whereby the temperature was maintained constant with an accuracy of $\pm$ 1°C. The disordered state of the specimens was produced by hardening from 700 to 800°C. The thermomagnetic treatment consisted of slow cooling from a temperature above the Curie point inside a magnetic field of 50 to 200 Oe whereby a possibility was provided of hardening the specimens during the magnetic treatment from any temperature. On the basis of the obtained results it is concluded that the phenomenon of ordering does not play an important role in the mechanism of thermomagnetic treatment. This is obvious from the fact that the thermomagnetic treatment can be effected at temperatures above T_c. Furthermore, measurement of the temperature dependence

Card 3/4 of the saturation magnetization indicates that in thermo-

Thermomagnetic treatment and processes of ordering. 126-2-21/35
Part 1. On the relation between the effect of thermomagnetic treatment and the processes of ordering.

magnetically treated alloys there is no appreciable ordering of the phases. Apparently ordering plays a secondary role during thermomagnetic treatment which consists in establishing a barrier to the formation of a magnetic texture, as can be seen from the results obtained for the alloy of iron with 12% Al.
There are 5 figures, 2 tables and 13 references, 2 of which are Slavic.

SUBMITTED: March 21, 1957.

ASSOCIATION: Institute of Metal Physics, Ural Branch of the Ac.Sc. USSR.
(Institut Fiziki Metallov Ural'skogo Filiala AN SSSR)

AVAILABLE: Library of Congress.

Card 4/4

126-5-3-6/31

AUTHORS: Shtol'ts, Ye. V., Shur, Ya. S. and Kandaurova, G. S.

TITLE: Magnetic Properties of Magnetically Anisotropic Specimens of Ferromagnetic Powders (Magnitnyye svoystva magnitno-anizotropnykh obraztsov iz ferromagnitnykh poroshkov) I. Magnetization Curves and Partial Cycles of Hysteresis Loops (I. Krivyye namagnichivaniya i chastnyye tsikly petel' gisterezisa)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol V, Nr 3, pp. 412-420 (USSR)

ABSTRACT: The magnetization curves and particularly the hysteresis loops have been investigated by the authors on MnBi specimens which were produced by sintering powders of manganese and bismuth at 550°C for two hours. The coercive force of the alloy amounted to 80 Oe. The MnBi powder was obtained by mechanical crushing and subsequent sorting into fractions with various particle sizes between 1.2 mm and 3μ. The investigated specimens were cylindrical and they were produced as follows: the powder was carefully mixed with the binding substance, an appropriate mould was filled with the mixture. Following that, the mould with the powder was exposed to a magnetic field and the hardening was effected in the magnetic field. (The angle

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Magnetic Properties of Magnetically Anisotropic Specimens of Ferromagnetic Powders

between the texture and the specimen axis is denoted by φ.) A dependence is established of the character of the anisotropy of the magnetization curves of magnetically textured specimens, made of thin powder of the MnBi alloy, on the dimensions of the powder particles. For certain particle dimensions, a magnetization process is observed in the longitudinally textured specimens which manifests itself in the fact that saturation is reached in fields of lower intensity than the maximum values of the residual magnetization and the coercive force. On the basis of the measured magnetization curves and of particular hysteresis cycles of isotropic and magnetically textured specimens of Mn-Bi alloys of various degrees of dispersion, it was established that in fine powders a magnetic transition structure from the multi-domain to the single-domain one as well as a single-domain structure can exist. A model of the transient magnetic structure is put forward.
There are 9 figures, 1 table and 7 references, 6 of which are Soviet and 1 French.

126-5-3-6/31

Magnetic Properties of Magnetically Anisotropic Specimens of Ferromagnetic Powders

ASSOCIATION: Institut Fiziki Metallov Ural'skogo Filiala AN SSSR (Institute of Metal Physics, Ural Branch of the Ac.Sc., USSR)

SUBMITTED: May 17, 1957

1. Metal powders--Magnetic properties 2. Ferromagnetic materials --Preparation 3. Hysteresis

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126-5-3-7/31

AUTHORS: Shur, Ya. S., Shtol'ts, Ye. V. and Kandaurova, G. S.

TITLE: The Magnetic Properties of Magnetically Anisotropic Specimens Made of Ferromagnetic Powders (Magnitnyye svoystva magnitno-anizotropnykh obraztsov iz ferromagnitnykh poroshkov) II. The Dependence of the Curves of Magnetization on the Method of Obtaining the Demagnetised State (II Zavisimost' krivykh namagnichivaniya ot sposoba polucheniya razmagnichennogo sostoyaniya)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.V, Nr 3, pp 421-427 (USSR)

ABSTRACT: A series of powders each with a uniform particle size, lying in the range 250 to 4u, was made from a manganese-bismuth alloy containing about 50% ferromagnetic phase. Magnetised dies were prepared from the powders by mixing them with a suitable filler, pouring into a mould, fusing at about 60°C and cooling in a magnetic field. The dies were then demagnetised either by cooling to -196°C in an alternating field, or at room temperature, by using a field of variable magnitude but constant sign to return the material to the demagnetised state from the appropriate point on one or other branch of the hysteresis loop. A part of the paper is devoted to the study of

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126-5-3-7/31

The Magnetic Properties of Magnetically Anisotropic Specimens Made of Ferromagnetic Powders II. The Dependence of the Curves of Magnetization on the Method of Obtaining the Demagnetised State

these 'curves of return'. Subsequent remagnetization to saturation was shown to follow a course dependent on the mode of demagnetization. Demagnetization by the first method permitted rapid remagnetization. After demagnetization at room temperature by a field of the same sign as the original magnetization, the remagnetization curve assumed a step-like form except at large particle sizes. If, however, the specimen was demagnetised by a field of opposite sign, remagnetization proceeded comparatively smoothly except at the lowest particle sizes when the curve again had a step-like appearance. An attempt is made to explain the observations qualitatively in terms of a transient magnetic structure intermediate between the single and many domained types. In presence of such a structure in the direction along the axis of the texture of magnetically anisotropic specimens, a fundamental role in the process of magnetization is played by the hysteresis in the formation and growth of remagnetization nuclei.

There are 8 figures and 2 references, both of which are Soviet.

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126-5-3-7/31

The Magnetic Properties of Magnetically Anisotropic Specimens Made of Ferromagnetic Powders II. The Dependence of the Curves of Magnetization on the Method of Obtaining the Demagnetised State

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR (Institute of Metal Physics, Ural Branch of the Ac.Sc., USSR)

SUBMITTED: May 17, 1957

1. Metal powders--Magnetic properties 2. Ferromagnetic materials --Test methods

Card 3/3

SHUR, Ya.S.

48-8-17/25

AUTHORS: Shur, Ya. S., Abel's, V. R., Zaykova, V. A.

TITLE: On the Part Played by the Closing Domains in Processes of Technical Magnetization (O roli zamykayushchikh oblastey v protsessakh tekhnicheskogo namagnichivaniya)

PERIODICAL: Izvestiya AN SSSR, Seriya Fizicheskaya, 1957, Vol. 21, Nr 8, pp. 1162-1167 (USSR)

ABSTRACT: The following magnetic domains are distinguished in this paper: Basic domains, which extend over the entire thickness of ferromagnetica in thin crystals; the slosing domains, which are situated on the edge of the sample or on its surface, in which the magnetic current of the basic domains is closed, and sub-domains - particularly closing domains - which form before defective places, where the uniformity of magnetization is disturbed. In the chapter: The shape of closing domains and their connection with natural crystallographic anisotropy the statement is made that, if the surface of the sample is parallel to one of the directions of the light magnetization, no closing domain is formed on the surface, and such a domain can be found only at the ends of the basic domains. On the boundary of the flat sample the closing domains form as triangles. This was disclosed for the first time by Landau and Lifshits. (In this paper various kinds of occurrence of

Card 1/3

On the Part Played by the Closing Domains in Processes of Technical Magnetization

closing domains are further described which are ascribed as "drop", "comb", "pine tree", "stem" etc.) . In the chapter: The dependence of the shape of closing domains on the thickness of the sample the change in the formation of the closing domains from a 100 -thickness of the sample up to 5 is described, and it is said that the particularly thin samples - under 5 have no more closing domains of the surface. In the chapter: Modification of the shape of closing domains in the case of an elastic extension of the sample it is said that, corresponding to the increase of the force causing extension of the sample parallel to the orientation of magnetization, the magnetic structure becomes gradually simplified until finally it goes over into the extinguishing closing domain. In the chapter: Transformations in closing domains accompanied by an increase of the intensity of the magnetic field it is said that in the weak fields the processes of shifting the boundaries of the basic domain take place and, if a closing domain is encountered, this boundary vanishes. The same, however, occurs again as soon as the place of this domain is passed. After the definite completion of the process (with growing intensity) these boundaries vanish, but the closing domains remain. With a further increase of intensity the

Card 2/3

SHUR, YA. S.

AUTHORS. Shur, Ya. S., Shtol'ts, Ye. V., Kandaurova, G. S.

TITLE. A Note on the Peculiarities of the Technical Magnetization of Fine Powder Samples with Texture (Osobennosti protsessov tekhnicheskogo namagnichivaniya v teksturovannykh obraztsakh iz tonkikh poroshkov).

PERIODICAL, Izvestiya AN SSSR Seriya Fizicheskaya, 1957, Vol. 21, Nr 9, pp. 1215-1219 (USSR).

ABSTRACT. The purpose of this paper was the investigation of the peculiarities of the magnetic properties of powders consisting of particles with a size approaching the critical dimensions. The single axis Mn-Al alloy utilized here displays an anisotropy of $\sim 10^{7}$ erg.cm^{-3}, being the largest among the ferromagnetica. It was established, that a reduction of the size of the particles lead to a essential modification of the magnetic properties. The investigation of the magnetic properties of fine highly coercive powders showed, that the existence of a magnetic transition texture in particles with a size larger than the critical dimensions must be assumed. In such cases the particles contain blocking domains apart from the basic domains. Upon certain conditions these blocking domains vanish and then the magnetic reversal process takes place just like in one-domain particles. Among other influences the blocking domains play a leading rôle in the technical magnetization process.

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Assn: Inst. Metal Physics, UFAN SSSR

SHUR, Ya. S

48-9-8/26

AUTHORS: Shur, Ya. S., Startseva, I. Ye.

TITLE: A Note on the Remaining Magnetism of Nickel and its Stability (Ostatochnaya namagnichennost' nikelya i yeye ustoychivost').

PERIODICAL: Izvestiya AN SSSR Seriya Fizicheskaya, 1957, Vol. 21, Nr 9, pp. 1240-1245 (USSR.).

ABSTRACT: In this paper the influences of various kinds of preparatory treatments of nickel, changing its crystal texture, on the magnitude of the remaining magnetism and on its stability with respect to alternating magnetic fields, temperature fluctuations and mechanical vibrations are investigated. It is shown, that the remaining magnetism of nickel samples can very in a wide range under the influence of various treatments of the material, which change its crystal texture. It is shown further, that the stability of the remaining magnetism with respect to different kinds of demagnetizing effects is also dependent on the crystal texture of the material, and that stability is not always connected with the magnitude of the coercitive force. Samples, which have undergone different treatment and displayed identical values of coercitive force, may possess a strongly varying stability of the remaining magnetism. The relations established here

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SHUR, YA. S.

AUTHORS: Shur, Ya. S., Luzhinskaya, M. G., Shubina, L. A. 48-9-14/26

TITLE: Note on the Influence of Elastic Stress and of a Combined Heat and Mechanical Treatment on the Magnetic Properties of Highly Coercive Alloys (Vliyaniye uprugikh napryazheniy i termomekhanicheskoy obrabotki na magnitnyye svoystva vysokokoertsitivnykh splavov).

PERIODICAL: Izvestiya AN SSSR Seriya Fizicheskaya, 1957, Vol. 21, Nr 9, pp. 1275-1279 (USSR.).

ABSTRACT: In this paper the influence of elastic stress (dilatation and torsion) and of a combined heat and mechanical treatment on the magnetic properties of some highly coercitive alloys was investigated. The combined heat and mechanical treatment consisted of imposing a dilating stress on the samples during tempering, under which conditions that crystal texture is formed, which corresponds to the highly coercitive state. It is shown, that the elastic stress and the heat and mechanical treatment have an essential influence on the magnetic properties of some highly coercitive alloys. These effects permit to increase the magnitude of H_c (coercitive force and $(BH)_{max}$ (maximum magnetic energy) of a number of alloys. For example, the value of H_c can be raised by 25 % and that of $(BH)_{max}$ by 40 % in the case of an

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SHUR, Ya. S. (Sverdlovsk)

"Magnetic Structure of Ferromagnetic Bodies."

report presetnted at Colloquium on Magnetism, Grenoble, France, 2-5 Jul 58.

Eval: B - 3,111,755

AUTHORS: Glazer, A. A. and Shur, Ya. S. SOV/126-6-1-6/33

TITLE: Thermomagnetic Treatment and Processes of Ordering (Termomagnitnaya obrabotka i protsessy uporyadocheniya) II Influence of Thermomagnetic Treatment on the Structural Transformations in Ordering Alloys (II Vliyaniye termomagnitnoy obrabotki na strukturnyye prevrashcheniya v uporyadochivayushchikhsya splavakh)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 1, pp 52-59 (USSR)

ABSTRACT: In earlier work (Ref.1) the authors showed that the thermomagnetic treatment in various ordering alloys (78-permalloy, 66-permalloy, perminvar and permendur) can be effective also when the external magnetic field is applied only at temperatures above the critical ordering temperature T_c. Furthermore, it was established that the curve of the dependence of the saturation magnetisation on the temperature $I_s(T)$ in specimens subjected to thermomagnetisation treatment coincide with the respective curves of alloys in disordered and non-ordered alloys. From that it was concluded that the magnetic single-axis character caused by thermomagnetic treatment is not due to ordinary ordering of the atoms

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Thermomagnetic Treatment and Processes of Ordering. II Influence of Thermomagnetic Treatment on the Structural Transformations in Ordering Alloys

but is due to some other regrouping of the atoms. Neel and Taniguchi et alii (Ref.2) arrived at similar conclusions, stating that a particular type of "orientated super-structure" forms. It was also pointed out that in the permendur alloy, which orders more quickly than the other investigated alloys, the thermomagnetic treatment is less effective. Apparently, the presence of an ordered structure influences the progress of the processes leading during thermomagnetic treatment to establishment of a single-axis magnetic anisotropy. Therefrom it can be concluded that the processes taking place during thermomagnetic treatment depend on the structural state of the alloy. To elucidate the features of the structural state of ferromagnetics after thermo-magnetic treatment, the authors investigated the effect produced by thermomagnetic treatment on specimens of certain ordering alloys after they have been brought preliminarily into the order or disorder state and also to study the kinetics of the process of ordering of

Thermomagnetic Treatment and Processes of Ordering. II Influence of Thermomagnetic Treatment on the Structural Transformations in Ordering Alloys

preliminarily thermomagnetically treated specimens. The investigations were effected on 60 x 4 x 0.2 mm specimens of the alloys 78-permalloy, 66-permalloy and perminvar (34% Ni, 34% Fe, 29% Co, 3% Mo). For producing the ordered state, the specimens were annealed at a temperature slightly below the critical ordering temperature T_c for durations up to 100 hours. A disordered structure was produced by hardening in oil from 700°C. The thermomagnetic treatment consisted of slow cooling from 700°C inside a magnetic field of 50 or 200 Oe. For evaluating the effectiveness of the thermomagnetic treatment the saturation magnetostriction was measured, which permits evaluating the degree of the magnetic texture, and also the coercive force, which gives an idea on the change of the magnetic properties during the thermomagnetic treatment. The same parameters enabled conclusions on the structural state of the alloy. The experimental results, which are graphed in Figs. 1-5, allow certain conclusions relating to the structural

Thermomagnetic Treatment and Processes of Ordering. II Influence of Thermomagnetic Treatment on the Structural Transformations in Ordering Alloys

state of a ferromagnetic which was annealed inside a magnetic field. It was found that this state is not the state of ordinary order including directional order. This view is supported by the earlier established fact that the thermomagnetic treatment can be effected at temperatures above T_c where ordering cannot take place. Furthermore, this is confirmed by the fact that the curve of the temperature dependence of the saturation magnetisation of specimens which have been subjected to thermomagnetic treatment coincide with the curves obtained for specimens of a non-ordered alloy. On the other hand, this state is not the ordinary state of chaotic distribution of the atoms according to the theory of Bozorth; this view seems to be borne out by the fact that, in a ferromagnetic annealed inside a magnetic field, the ordering takes place more slowly than in a non-ordered alloy. Such a difference in the kinetics of ordering permits the assumption that the structure of the non-ordered specimen and of specimens annealed inside

Thermomagnetic Treatment and Processes of Ordering. II Influence of Thermomagnetic Treatment on the Structural Transformations in Ordering Alloys

a magnetic field differ. It can be anticipated that due to annealing inside a magnetic field a particular structural state will occur in the ferromagnetic which differs from the ordinary ordered state or from the directional state as well as from the disordered state. It can, therefore, be assumed that a small quantity of atoms participate in the formation of this particular structural state, since during thermomagnetic treatment of disordered alloys their saturation magnetisation does not change and the formation of a magnetic uniaxiality during thermomagnetic treatment proceeds faster than the ordering of the alloy. It is most likely that the structural state established during thermomagnetic treatment represents an "orientated super-structure" which has been predicted theoretically by Neel and Taniguchi et alii (Ref.2).

SOV/126-6-1-6/33

Thermomagnetic Treatment and Processes of Ordering. II Influence of Thermomagnetic Treatment on the Structural Transformations in Ordering Alloys

There are 5 figures and 3 references, 1 of which is Soviet, 2 English.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR (Institute of Metal Physics, Ural Branch of the Ac.Sc., USSR)

SUBMITTED: May 6, 1957.

Card 6/6 1. Alloys--Magnetic factors 2. Alloys--Heat treatment
3. Magnets--Preparation 4. Magnets--Structural analysis

SOV/126-6-2-5/34

AUTHORS: Kandaurova, G. S., Shur, Ya. S. and Shtol'ts, Ye. V.

TITLE: The Magnetic Properties of Magnetically Anisotropic Specimens Prepared from Ferromagnetic Powders. (Magnitnyye svoystva magnitno-anizotropnykh obraztsov iz ferromagnitnykh poroshkov). III. Anisotropy in Magnetic Properties (Anizotropiya magnitnykh svoystv)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 2, pp 229-236 (USSR)

ABSTRACT: The domain structures of powders of MnBi alloy and Co are determined from disc-shaped specimens prepared from powders of 1 to 100 μ in particle size. The Mn-Bi alloy was prepared by sintering the components at 320°C; MnBi content about 50%. The sinter was powdered and used without annealing. The Co was powdered from a piece of cast metal and annealed in vacuo at 600°C. (The method of preparing the discs is not described). Fig.1 shows the magnetization curve for an MnBi disc of particle size 25 μ, with various angles φ between the field and texture axes. Fig.2 gives the corresponding hysteresis loops. Fig.3 shows a polar diagram of the coercive force for MnBi discs of various particle sizes (texture

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The Magnetic Properties of Magnetically Anisotropic Specimens Prepared from Ferromagnetic Powders. III. Anisotropy in Magnetic Properties

axis horizontal). Fig.4 shows how the coercive force of MnBi varies with particle size for two values of φ; Fig.5 resembles Fig.3 but the residual magnetization is shown instead. Figs. 6 and 7 are analogous to Figs. 1 and 3 respectively, for Co powder of 4μ particle size; Fig.8 is analogous to Fig.4 and Fig.9 to Fig.5. The results are discussed in the light of the prediction that single-domain particles should occur in larger sizes the higher the anisotropy constant and saturation magnetization. The results agree with this prediction in general, but the precise shapes of the theoretical curves (shown dashed in Figs.10 and 11) are not the same as those found by experiment for MnBi of 4μ particle size. Some of these effects can be attributed to the method used for demagnetizing the MnBi powder (decreasing alternating

SOV/126-6-2-5/34

The Magnetic Properties of Magnetically Anisotropic Specimens Prepared from Ferromagnetic Powders. III. Anisotropy in Magnetic Properties

field at liquid nitrogen temperature).
There are 4 equations, 11 figures and 8 references,
6 of which are Soviet, 2 English.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR
(Institute of Metal Physics, Ural Branch of the Ac.Sc., USSR) and
Ural'skiy gosudarstvennyy universitet imeni A.M.Gor'kogo
(Ural State University imeni A. M. Gorkiy)

SUBMITTED: May 17, 1957

Card 3/3 1. Ferromagnetic materials--Magnetic properties 2. Alloys--Sintering 3. Powders--Applications 4. Alloys--Heat treatment

SOV/126-6-3-5/32

AUTHORS: Shur, Ya. S., Shtol'ts, Ye. V. and Kundaurova, G. S.

TITLE: Magnetic Properties of Magnetically Anisotropic Specimens of Ferro-magnetic Powders. IV. Temperature Dependence of Magnetic Properties of Powdered Specimens of the Alloy MnBi (Magnitnyye svoystva magnitno-anizotropnykh obraztsov iz ferromagnitnykh poroshkov. IV. Temperaturnaya zavisimost' magnitnykh svoystv poroshkovykh obraztsov splava MnBi)

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ABSTRACT: Previous papers of this series were published in Nrs 5 and 6 of the present journal (1957, Refs.1-3). The anisotropy of the coercive force in powdered specimens of MnBi in the temperature region -196 to +20°C has been studied and results are now reported. A study was made of the magnetisation curves, recovery curves and other features of the hysteresis loops at a temperature of -196°C. It is shown that when the temperature of finely powdered specimens is reduced from +20° to -196°C, the form of the magnetic structure of the particles changes due to a reduction in the constant of anisotropy. A study of the temperature dependence of the magnetic properties of specimens of MnBi powders of different dispersity has shown that in the same

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specimens at different temperatures the existence of magnetic structure of different form may be observed. Thus, the transition structure which is present at room temperature in fine powders (1 - 10 μ) disappears at -196°C and instead of it a multidomain structure is found. This is connected with the reduction in the constant of anisotropy at low temperatures. There are 6 figures, 1 table and 11 references, of which 8 are Soviet, 2 French and 1 German.

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1. Bismuth-manganese powder alloys--Magnetic properties
2. Bismuth-manganese powder alloys--Temperature factors