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Preparation of non-liquating lead-zinc alloys. A. A. Bochvar and A. Ya. Ulyanov. *Tsvetnye Metal.* 1932, No. 8/9, 28-32.—Alloys of Zn with 1% of Pb can be prepd. by dissolving the required amt. of Pb in the liquid Zn at high temps. However, upon solidification the Pb seps. out, and liquation takes place. In order to prep. a uniform alloy free from liquation the authors made 1-3% Pb alloys by introducing $PbCl_2$ into molten Zn. Upon solidification the structure was found to be uniform, and the macrographs obtained by etching with HCl showed uniform darkening, indicating the absence of segregation or liquation. The fact that the Pb content of the ingots exceeded the soly. limit indicated that Pb was present as an emulsion. On remelting, part of the Pb sepd. out. Further expts. indicated that the liquation can be partly prevented by adding small amts. of Mg, and wholly by Cd, Fe and Cu. Tests by dissolving thin rolled plates in a 40-50% soln. of NH_4NO_3 showed some traces of coagulation of Pb, although not sufficient to cause liquation. The existence of coagulation was interpreted as indicating the absence of a solid soln. of Pb in Zn. B. N. Daniloff

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On the Cause of the "Hardness" of Electrolytic Zinc. A. A. Butchkar and A. J. Uljanow (*Zeitsch. Metally* (*The Non-Ferrous Metals*), 1932, 7, 33-36; *Chem. Zentr.*, 1934, 105, I, 2343).—The hardness of zinc does not primarily depend on the thermal treatment, since the presence of iron has a profound effect on the recrystallization process, as little as 0·2% preventing it entirely. The hardness is unaffected by 0·2% lead, but 0·1-0·2% cadmium increases it appreciably. In making zinc sheets of uniform hardness strict control of the iron content is essential.—A. R. P.

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***Investigations of the Transformations in the Solid State in Magnesium-Silicon Aluminium Alloys.** A. A. Botchvar, K. W. Gorew, and A. M. Korolkow (*Metallurg* (*The Metallurgist*), 1932, 8, (1), 7-20; *Chem. Zentr.*, 1934, 105, I, 1931).—[In Russian.] The equilibria in the ternary system up to 2% silicon and 3% magnesium have been determined. The solid solubility of silicon and Mg_2Si in aluminium is decreased by excess of either constituent, contrary to the statement of Hanson and Gayler (*J. Inst. Metals*, 1921, 26, 321-350) that excess of silicon increases the solid solubility of Mg_2Si. B., G., and K. also find that excess of magnesium has a greater depressing effect on the solid solubility of Mg_2Si in aluminium than stated by H. and G. From the changes in hardness on heat-treatment of Aldrey with 0·2-0·4% iron it is shown that an excess of silicon increases the effect of heat-treatment, but has no effect in iron-free Aldrey, except to retard somewhat the ageing; this difference is attributed to the formation of FeSi, so that an excess of silicon is necessary to get the full effect due to Mg_2Si.—A. R. P.

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†On the Problem of a Scientific Basis for a Standard for Babbitts. A. Botchvar (*Vestnik Standartizatii* (*Messenger of Standardization*), 1932, 11-12 [47-48], 41-46).—[In Russian.] A review of various researches on Babbitts which might serve as a basis for preparing a standard for Babbitts.

—N. A.

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***A Study of the Heat-Treatment of Alloys of the Aldrey Type.** F. A. Borin, A. A. Botchvar, I. P. Velichko, K. V. Gorey, and M. O. Kuznetsov (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1932, (12), 94-108; C. Abs., 1933, 27, 5701).—[In Russian.] A series of aluminium-magnesium-silicon alloys containing silicon 0·2-0·9, magnesium 0·36-1·54, and iron 0·2-0·3% was made and rolled according to the usual commercial practice. By a combined variation in composition and heat-treatment a product was obtained of better mechanical properties than had been possible heretofore. Tensile strength values of 36 and 38 kg./mm.² were obtained, with corresponding elongations of 15 and 8%. Excess silicon considerably improved the mechanical properties of the alloys with low Mg_2Si content, and 0·5% excess silicon improved the qualities of all the alloys studied; these phenomena are explained on the basis of the solubility relations of the alloy. Quenching from 525° C. followed by tempering at 140°-150° C. for 48 hrs. or longer is recommended for alloys of this type. The most beneficial effect of heat-treatment on the mechanical properties was obtained in the alloys containing 0·7, 0·75, and 0·90% silicon, and 0·40, 0·50, and 0·90% magnesium, respectively, or generally, in the aluminium-magnesium-silicon alloys with 0·4-0·9% magnesium and with an excess of 0·4-0·5% silicon over the amount of silicon theoretically required for the formation of Mg_2Si.—S. G.

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Bochmetow, E. F., A. A. Botschvar, G. S. Shdanow, and J. S. Umanski. *The Recrystallization of Metals.* [In Russian.] Pp. 351. 1933. Moscow and Leningrad: Gosmaschmetisdat. (Rbl. 8.)

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Investigation of transformations in the solid state of aluminum-magnesium-silicon alloys. A. A. Bochvar, K. V. Gorev and A. M. Korolkov. *Metallurgist* (U. S. S. R.) 1933, No. 1, 7-30.—A new constitution diagram of the Al-Mg-Si system, based on the microstructures of 47 alloys contg. 0-3% Mg and 0-2.75% Si, is presented. Melts were prepd. under a NaCl-KCl-LiCl flux. The alloys were supercooled to 150° for 4-18 hrs., then held for 10 days at temps. of 200°, 300°, 400°, 500° and 550° and quenched in cold water. Brinell tests made immediately and after 4 days' aging at 150° showed max. aging in specimens with max. of Mg_2Si. Excess Si increases the effect of heat treating if 0.2-0.4% Fe is present, but decreases it if Fe is almost absent. The diagram indicates a max. soly. of Mg_2Si in Al of 1% at 500° and 0.45% at 400°. Soly. decreases if excess Si or Mg is added, in contradiction to the diagram of Hanson and Gaylor (*C. A.* 16, 231), which indicates an increase. The path of the soly. isotherms in the Al-Mg_2Si-Mg field in general agrees with those of H. and G. The isotherms for the soly. of Si are newly constructed. H. W. Rathmann

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***Abnormal Structures in Slowly Cooled Alloys of the Eutectic Type.** A. A. Botchvar and K. V. Rusetsky (*Vestnick Metallopromishlennosti* (*Messenger of the Metal Industry*), 1933, (1), 59–61).—[In Russian.] Abnormal structure of alloys of the eutectic type is characterized by the appearance of "halos" of the second phase, surrounding primary crystals. Both hypo- and hypereutectic alloys of bismuth, cadmium, lead, and tin were investigated. In this series each metal forms halos round the metals which precede it, the further apart the metals in the series the sharper being the halo.—D. N. R.

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Transformations in the solid alloys of aluminum, magnesium and zinc containing up to 30% zinc and 12% magnesium. A. A. Bochvar and M. O. Kuznetzov. *Metallurg.* 1933, No. 2, 7-14.—Previous investigations differ widely as to the solv. of Zn in Al

probably because of the similarity of the α- and γ-phases. For this reason x-ray and aging methods are preferred to thermal, elec. cond. and dilatometric methods. Alloys of the above compn. after casting were heat-treated by holding at 200°, 400° and 450°, resp., for 10 days and quenching in cold water. The nietched specimens were examd. with the microscope to det. the no. of components present. Hardness tests made over a 10-day aging period show practically complete transformations in 24 hrs. in all cases. The aging effect increases with increase of $MgZn_2$. MgSi, present as an impurity in all cases (< 0.2%), did not materially affect the results. Solv. of $MgZn_2$ in Al as detd. by microanalysis of the quenched specimens is 16-17% as compared to the Sander and Meissner value of 25%. Hardness tests confirmed these results. H. W. Rathmann

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*On the Crystallization of Ternary Eutectics. A. A. Botchvar and K. V. Gorev (*Vestnick Metallopromishlennosti* (*Messenger of the Metal Industry*), 1933, (2), 44–45).—[In Russian.] Cf. *J. Inst. Metals*, 1933, 53, 238. Experiments are described to ascertain the order in which the different phases crystallize in the ternary eutectics, lead-tin-cadmium, bismuth-tin-cadmium, and bismuth-lead-cadmium. The order of crystallization irrespective of the presence of an excess of one component is cadmium, lead, tin, bismuth.

—D. N. S.

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*Determination of Upper Critical Points in Antifriction Alloys. F. A. Boria and A. A. Botchkar (*Tsvetnye Metally* (*The Non-Ferrous Metals*), 1933, (2/3), 101-106; *C. Abs.*, 1934, 28, 4353).—[In Russian.] The "upper critical points" (the minimum temperatures of quenching at which no separation of hard crystals from liquid metal occurs) were determined for several Babbitt metals by microscopic examination of specimens quenched in copper moulds. In all cases the critical points were found to be higher than the values given in the literature.—S. G.

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"The Transformations in Solid Alloys of Aluminium with up to 30% Zinc and 12% Magnesium. A. A. Botchvar and M. O. Kuznetsov (*Metallurg* (*The Metallurgist*), 1933, 8, (2), 7–14; *Chem. Zentr.*, 1934, 105, I, 2345).—[In Russian.] The solubility isotherms of the ternary system magnesium-zinc-aluminium have been determined at 200°, 400°, and 430° C. by micro-analysis of specimens quenched in water after prolonged annealing. The solubility of $MgZn_2$ is a maximum of 16–17%, whereas Sander and Meissner found 25%. The phases in equilibrium with the ternary γ-solid solution could not be ascertained by the method employed.—A. R. P.

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Lines of Research in the Field of High-Resistance and Heat-Resistant Alloys. A. A. Botchvar (*Vestnik Ingenerov i Tekhnikov* (*Messenger of Engineers and Technologists*), 1953, (8), 340–341).—[In Russian.] N. A.

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Relation between upper critical points and copper content in bearing metals. A. A. Bochvar and V. P. Arkhipov. *Tsvetnaie Metal.* 9, No. 1, 131-4(1934); *Met. Abstracts* (in *Metals & Alloys*) 6, 244.—Critical points found in bearing metals and reported before (cf. *C. A.* 28, 4353[3]) were investigated in the light of their Cu contents. In an alloy contg. 85% Sn and 12% Sb change in Cu from 3 to 7% raised the critical point from 330° to 405°. With 16% Sn, 16% Sb, 68% Pb change in Cu from 1.3 to 3% raised the critical from 400° to 510°. In 42% Sn, 14% Sb and 40% Pb the increase of Cu from 3 to 7% increased the critical point from 415° to 510°. G. G.

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Eutectic crystallization and the formation of rims near primary crystals. A. A. Bochvar. *Metallurg* 9, No. 10, 3-6(1934); cf. *C. A.* 29, 9877.—Crystn. in the system azobenzene-piperonal was investigated. H. W. R.

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On the Process of Eutectic Crystallization and the Formation of Concentric Rings in Eutectic Alloys. A. A. Botchvar (*Metallurg* (*Metallurgist*), 1934, (10), 3–8).—[In Russian.] The mechanism of eutectic crystallization has been studied by observations on the azobenzene–piperonal eutectic which solidifies at 26° C. and exhibits many of the characteristics of metal eutectics. Normally crystallization is very slow, and undercooling effects readily occur. When solidification occurs at 20° C. no eutectic structure can be observed, and at 13°–20° C. separate crystals of the individual phases are first formed, and eutectic crystallization ensues only when these crystals come into contact with one another. At still lower temperatures the eutectic separates in a spherulitic form. Similar observations have been made on certain metal eutectics; in hypo- and hypereutectic alloys the eutectic crystallization occurs only after contact of the crystals of the 2 metals. The cored effect often observed in eutectic alloys is attributed to differences in the linear rate of crystallization with increase in the local concentration of one of the constituents. In bismuth–cadmium–lead–tin alloys which are allowed to cool under conditions producing coring, the metals will form concentric rings round one another in the order given, bismuth being outside and tin inside.—N. A.

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Botchvar, A. A. *Investigation of the Mechanism and Kinetics of Crystallization of Eutectic-Type Alloys.* [In Russian.] Pp. 82. 1933. Leningrad and Moscow: ONTI. (Rbl. 1.70.)

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Betekhtar, A. A. *The Science of Metals.* [In Russian.] Pp. 288. 1935. Moscow and Leningrad: Glaw. red. lit-ry po svetnye metallurgii. (Rbl. 3.75.)

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Babbitts. A. Bochvar (*Vestnick Standartizazii* (*Messenger of Standardization*), 1938, 1(61), 18-20).—[In Russian.] The basis for selection of a standard Babbitt is indicated and the relation of the Soviet standard to the OST/VKS 88 Babbitt is given.—N. A.

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***Obtaining High-Grade Aluminium-Bronzes and Brasses.** A. A. Bocharov and N. Laktionova (*Tsvetnye Metally* (*Non-Ferrous Metals*), 1935, (1), 104–108; *C. Abs.*, 1935, 29, 5399).—[In Russian.] A study was made of the effect of additions of aluminium, nickel, and iron on the hardness of copper-zinc alloys. The compositions of the alloys varied between the following limits: copper 55·0–75·0, zinc 20·0–32·0, aluminium 0·5–5·0, nickel 2·0–12·0, iron 0·5–0%. Hardness measurements were carried out on castings, before heat-treatment, after hardening at 900° C. in water, and after annealing for 2 hrs. at 450°–500° C. The maximum hardness was obtained with the following samples, annealed at 450°–500° C. for 2 hrs.: (1) copper 67, zinc 28, aluminium 2, and nickel 3%; (2) copper 69, zinc 25, aluminium 2, and nickel 4%; (3) copper 70, zinc 25, aluminium 2, and nickel 3%; (4) copper 65, zinc 25, aluminium 2, and nickel 8%; (5) copper 68·5, zinc 25, aluminium 2, nickel 4, and iron 0·5%; (6) copper 69·5, zinc 25, aluminium 2, nickel 3, and iron 0·5%. The Brinell hardness of these samples was 212, 227, 212, 227, 212, and 227, respectively.—S. G.

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Recrystallization of metals. A. A. Bochvar, N. M. Belov and B. A. Granovskii. *Tsvetnye Metal.* 1936, No. 3, 80-0.—When strips of Zn, Al and Cu cold worked beyond the crit. degree (i. e., beyond reduction by cold working which produces max. grain growth at a given temp.) are heated in such a manner as to produce a temp. gradient from m. ps. of the metals to room temp., the max. grain growth takes place not at the locations heated to max. temps. but at some temp. below the max. Both below and above this temp. of max. grain growth, finer grain is produced. Toward the lower temp. end a distinct line of sepn. between fine and coarse grain is observed, while toward the higher temp. end the grain size changes gradually. The authors believe that the existence of optimum temps. for grain growth is dependent on the presence of impurities and rates of cooling and heating, and suggest an explanation of the observed phenomena. At the temps. near m. ps. grain growth is prevented by liquation at the grain boundaries. At the optimum temps. the impurities apparently become dissolved in solid solns. and enhance grain growth. Rapid heating was observed to produce coarser grain. The greater the amount of impurities in Zn the more pronounced is the effect of rate of heating on grain growth.

B. N. Daniloff

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How to Avoid Porosity in Special Silumin Castings by Casting Under Pressure. A. A. Botchvar and A. G. Spassky (*Aviopromishlennost* (*Aero. Ind.*), 1936, (7), 5-11).—[In Russian.] Pressure castings of Silumin (silicon 7-10, magnesium 0·2-0·25, and cobalt 0·4-0·6%) up to 25 kg. in weight can be produced free from porosity and with all parts, even of complicated patterns, accurately reproduced. The pressure is applied 10-15 seconds after filling the mould, or 25-30 seconds after beginning to pour. Details are given of the method used in casting parts weighing up to 100 kg. in weight by this method; sections cut from these indicated better homogeneity, and better mechanical properties, than in similar gravity castings. With pressure-casting, more magnesium than usual can be added to the alloy to increase its mechanical stability; thus, addition 0·3% of magnesium to the above alloy increases its yield-point to 30-31 kg./mm.², with an elongation of 3%.—N. A.

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Crystallization of ternary eutectics. A. A. Bochvar and K. V. Gorev. *Ann. secteur anal. phys. chim. gén.* (U. S. S. R.) 8, 283-90(1936); cf. G. Tammann and Bochwar, *C. A.* 21, 355.—Pb-Sn-Cd, Bi-Pb-Cd and Bi-Sn-Cd alloys were melted and then slowly cooled. Specimens were etched with 1% HNO_3 and the structure studied by photomicrographs. The incipient crystn. of all the 3 phases takes place not simultaneously but successively. The metals can be arranged in the following order of their sepn.: Cd, Pb, Sn, Bi. Chas. Blanc

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The Problem of Finding Hardenable Copper Alloys. A. A. Botchvar and I. I. Shaposhnikov (*Zvetnye Metally* (*Non-Ferrous Metals*), 1956, (9), 95-97).—[In Russian.] Brasses containing aluminium (zinc 25, aluminium 3·5-5%) are capable of hardening. The method consists in quenching from 800°-850° C., and annealing at 250° C. for 2 hrs. The hardening effect is especially pronounced if small quantities of silicon (0·25%) or manganese (1-1·5%) are added.—N. A.

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CA

The effect of thermal treatment of sheet zinc on the Eriksen depression test. A. A. Bochvar and L. I. Dmitriev. *Ann. secteur anal. phys.-chim., Inst. chim. gen.* (U. S. S. R.) 9, 147-52(1936).—Ul'yanov has observed that "hard" (incompletely recrystd.) sheet Zn gives greater Eriksen depression no. than the "soft," recrystd. product. In a study of this anomaly, the Eriksen tests revealed a different relation for heated sheet Zn from that for Cu, brass and Al sheets similarly treated. A cubic system (Cu, brass, Al) is characterized by a considerable no. of possible sliding planes, while a hexagonal system (Zn) has only 1 possible sliding plane. In deformation of metals of cubic system, practically no duplication takes place. Hence the no. of sliding planes in the crystallite remains unchanged, the planes themselves with the increasing reduction of crystallite become distorted and "stabilized." The presence of uniform orientation and the intercryst. deformation do not affect the metals of the cubic system and their power for vol. deformation. As a result these metals behave normally, increasing the Eriksen no. with the thermal treatment and decreasing it with deformation. In the deformation of metals of hexagonal systems a strong duplication takes place with the appearance of a new possible sliding plane nearly perpendicular to that already present. The deformation ability of the metal must thus increase. This is not apparent in a linear stretching (the elongation normally drops with the increasing deformation), because of the definite orientation with the unfavorable position of the 2 possible sliding planes, viz., one at a very small and another at a very great angle to the effective force. In the Eriksen test with the force acting in the sphere (vol. deformation), the sliding plane can be utilized. Hence with the increasing deformation the Eriksen nos. rise. In respect to the grain reduction and the increase of surface limits, these in a metal with impeded sliding can cause intercryst. deformation resolving itself into the intracryst. deformation. In practice, the stamping of thermally treated brass and hard Zn sheets is preferable. Theoretical bases in the selection of optimum temperatures for monophase metals. A. A. Bochvar and G. G. Putrikin. *Ibid.* 133-8.—Expts. with brass and Zn showed that the thermal treatment of metals at temps. between the initial and complete recrystn. results in an irregular structure, consisting in spots of new recrystd. grains and old, often very large, deformed grains. This condition causes random distribution of the subsequent deformation and the formation of weak spots. Hence, rational thermal treatment should be effected at the temps. at least above those of the top curve for complete recrystn. In practice, the moment of the formation of a monocrystal may be considered as that of a complete recrystn. Therefore, the character of the curve of complete recrystn. in addn. to the usual curve of initial recrystn. is of theoretical and practical interest. The presence of a curve for distribution of recrystn. throughout the vol. and its position considerably above the curve for the initial recrystn. explains the failure of a complete recrystn. of deformed metals at low temps. even at excessively long treatments. The usual diagrams of recrystn. with only 1 curve, dividing the recrystd. samples from the unrecrystd. in the plane: temp.-degree of deformation, are, therefore, useless. The new line on the recrystn. diagrams gives the min. temp. for effective thermal treatment.

Chas. Blanc

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"The Theoretical Basis for Selecting Optimum [Annealing] Temperatures for Single Phase Metals. I.—The Question of Recrystallization Diagrams. A. A. Botchvar and G. G. Pazikin (*Izvestia Sektora Fiziko-Khimicheskogo Analiza* (*Acad. Sci. Anal. Phys.-Chim.*), 1936, **9**, 153-158).—[In Russian.] In the rolling of metal sheets different parts of the sheet and even different parts of individual crystals undergo different degrees of reduction and therefore the degrees of reduction given in recrystallization diagrams must be regarded as mean values for the whole sheet. For each "mean" value two temperatures are of importance, that at which recrystallization commences in the most strongly deformed portion, and that at which it spreads throughout the specimen. The interval between the two recrystallization curves for copper and 68 : 32 brass is small for high degrees of reduction, but increases considerably with decrease in the degree of reduction, being as much as 100°–300° C. in some cases. Using the values obtained for the average grain size of the recrystallized specimens after each heating period, spatial recrystallization diagrams for copper and brass have been constructed for the temperature interval between that at which the recrystallization just commences and that at which it has spread throughout the specimen.—N. A.

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*Problem of the Modification of Silumin by Salts. A. A. Botchvar and A. G. Spansky (*Zvetnye Metally (Non-Ferrous Metals)*, [illegible], (10), 81-83).—[In Russian.] A study was made with a special Silumin containing cobalt 0·4, magnesium 0·25, and silicon 9–10%. It was found that this alloy could be satisfactorily modified by a 2:1 mixture of sodium fluoride and sodium chloride at 740°–790° C.—N. A.

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Botschvar, Andrei Anatoljewitsch. *Metal Science (Short Course).* [In Russian.] Second, Revised and Enlarged Edition. Pp. 352. 1937. Moscow and Leningrad: Onti. (Rbl. 5.)

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Annealing of magnesium and "electron." A. A. Bochvar and E. M. Savitskii. *Tsvetnye Metal.* No. 5 6, 100-102(1937).—Samples of Mg (99.9% pure) and "electron" (Al 0, Zn 1.0, Mn 0.35 and Mg 92.65%) were cold worked to various degrees and annealed at temps. from 150° to 600° for sufficient time to attain complete recrystn. It was noted that in both metals the recrystn. is accomplished by the growth of existing grains at the expense of others when the percentage reduction by cold working does not exceed 9%; above this the recrystn. is accomplished by the formation and growth of new grains. It is recommended that the min. temps. of annealing should be 150-200° for Mg, and 175° to 200° for electron. At 450° rapid grain growth begins; this is taken as the upper limit of annealing temp.

H. N. Daniloff

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BOTCHVAR, A. A. "*The Principles of the Heat Treatment of Alloys.*" 4th edition. Pp. 272. Leningrad and Moscow, 1938: Onti. (Price 4 roubles.) (In Russian.)

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Quantitative relationship of the composition of alloys to strengthening by thermal treatment. A. A. Bochvar and M. V. Zakharov. *Sbornik Nauch. Trudov Moskov. Inst. Tsvetnykh Metal. i Zol* 1938, No. 5, 41-5; *Khim. Referat. Zhur.* 1, No. 11-12, 99(1938). Increases of hardness in a no. of Al-Cu alloys (99.99% pure Al and electrolytic Cu) after natural and artificial aging are tabulated and presented in the form of curves. A simple formula is deduced from which fairly accurate max. values of the hardening of the Al-Cu alloys can be obtained. Conditions of detn. of hardening are not the same for all alloys, because in some, the max. value has not been reached (owing to the incompleted process), while in other alloys this max. value may have been passed as a result of excessive coagulation of the srpd. particles. W. R. Henn

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CN

Conditions for the formation of columnar structures. A. A. Bochvar and A. I. Vagina. *Sbornik Nauch. Trudov Moskov. Inst. Tsvetnykh. Metal. i Zol* 1938, No. 5, 45-8; *Khim. Referat. Zhur.* 1, No. 11-12, 98 (1938).—Genders' hypothesis (*C. A.* 20, 1582) that a columnar structure is obtained more easily in alloys with small intervals between the liquidus and the solidus, and an equiaxed structure is obtained more readily at large intervals of temp. was confirmed for the alloys Sb-Bi, Al-Zn, Sb-Sn and Mg-Cd. The velocity of diffusion greatly affects the formation of columnar structures.

W. R. Henn

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The possibility of the utilization of thermal treatment to improve tin-base antifriction alloys. A. A. Bochvar and A. I. Egorova. *Sbornik Nauch. Trudov Moskov. Inst Tsvetnykh Metal. i Zol* 1938, No. 5, 49-52; *Khim. Referat. Zhur.* 1, No. 11-12, 93(1938).—Expts. on the structural changes during hardening of Sn-Sb alloys show that the Sn-Sb diagram must be changed in the part which approaches the Sn component. Structural changes by thermal treatment of the Sn-Sb alloys, and the effect on antifriction properties of the Sn-base alloys (used for the manufacture of gears) are discussed. W. R. Henn

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The collective recrystallization of metals. A. A. Bochvar, M. M. Belov and B. A. Gramovskii. *Sbornik Trudov Moskov. Inst. Tsvetnykh Metal. i Zol* 1938, No. 5, 60-70; *Khim. Referat. Zhur.* 1, No. 11-12, 92(1938); cf. *C. A.* 31, 5729[9].—The influence of the heating temp. on the size of the grains obtained in collective recrystn. was shown experimentally. The expts. were performed with samples of sheet electrolytic Zn. An optimum temp. of the collective recrystn. for Zn was found. Similar expts were performed with Al 99.5% and with Cu 99.9% in which a temp. of the max. growth of the grains during the recrystn. was observed. The existence of the optimum temp. of the growth of the grains is caused by the presence of impurities (even in small quantities) which are fused together above the optimum temp., and which thus break the contact between the grains. The heating velocity has a very strong influence on the size of the grains obtained as a result of collective recrystn.

W. R. Henn

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Modification of Silumin with salts. A. A. Bochvar and A. G. Spasskii. *Sbornik Nauch. Trudov Moskov. Inst. Tsvetnykh Metal. i Zol.* 1938, No. 5, 70-2.—Numerous expts. for the modification of Silumin with salts under lab. and under plant conditions were performed. Silumin contg. 0.4% of Cu, 0.25% of Mg and 9-10% of Si treated with a 2:1 mixt. of NaF and NaCl in amts. from 0.7 to 1.0% of the wt. of Silumin can be modified at temps. even below 800°. Sometimes a coarsely cryst. substance is obtained which is due to the presence of Fe in the alloy. B. and S. recommend modifying Silumin with salts only (without metallic Na) at a lowered temp. **Finding of "ennobling" substances for copper alloys.** A. A. Bochvar and I. I. Shaposhnikov. *Ibid.* 63-6.—On the basis of partially investigated diagrams of the compn. of ternary systems the alloy Cu-Zn-Al was subjected to an "ennobling" thermal treatment consisting of tempering and of "letting down." Preliminary expts. showed that by thermal treatment of Al lattens substances with improved mech. properties are obtained. The optimum temp. for tempering is 800-850°, and for "letting down" 250°. Through *Khim. Referat. Zhur.* 1, No. 11-12, 93-4 (1938). W. R. Henn

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The Tendency of Aluminium Alloys to Crack Under the action of Shrinkage Stresses. A.A. Bochvar and M. K. Makimdshanova (Metallurg (Metallurgist) 1939, (2), 75-80).-(In Russian) The first method of investigation adopted consisted in determining the area of cross-section of an I-shaped specimen which would just ensure the formation of cracks under the action of stresses set up owing to inhibited shrinkage, while in the second method the force required to counteract shrinkage in order to crack the specimens was determined. Commercially pure aluminium (99.5%) and alloys of aluminium containing 2, 4, 6, 8, and 12% silicon and 4.8 and 12% copper were studied. In addition, a study was made of the effect of iron and of modification on the tendency of Silumin to crack. Cracking was found to decrease markedly as the silcon content of the Silumin increased. Modification with salts had no effect, while modification with sodium favoured the tendency to crack. Iron in low-silicon alloys increased cracking. Aluminium-copper alloys tended to crack irrespective of the copper content. The solidification interval is not a deciding factor in this connection. N.A.

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***The Production of Sound [Aluminium] Castings.** A. A. Bochvar and A. G. Spassky (*Litvynoe Delo*, **1939**, (5), 23-25). [In Russian.] A method is described in which molten aluminium alloys are introduced into the mould under suction and subsequently allowed to solidify under pressure. Experiments have been carried out on modified Silumin (silicon 10, manganese 0·4, magnesium 0·25%). The rate of filling the mould can be controlled by the degree of suction. The method yields well-filled moulds and gives freedom from the shortcomings of the ordinary methods of casting, such as formation of oxides and splashing.—N. A.

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[redacted] Under Vibrational Stresses. [redacted] (Metallurgist), 1939, 14, [redacted] As a measure of [redacted] cross-section of [redacted] without cracking was adopted, and the tensile stress was determined at the same time by means of a dynamometer. Commercial aluminium (99·5%), Silumin with 2, 4, 6, 8, 10, and 12% of silicon, and aluminium-copper alloys containing 4, 8, and 12% copper, have been examined. Increase of the silicon content of Silumin decreases the tendency to crack. Addition of sodium increases the cracking somewhat, while addition of iron has a very deleterious effect, especially on Silumins of low silicon content. Increase in copper improves the resistance of aluminium-copper alloys, although in general their tendency to crack is greater than that of the Silumin-type alloys.

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N/A

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Bochvar, A. A. *Metallurgy.* [In Russian.] Third, revised edition. 17p. 372. 1940. Moscow and Leningrad: Metallurgizdat. (12.50 Rbl.)

1943

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Vashchenko, A. A. *The Basis of the Heat-Treatment of Alloys.* [In Russian.] 5th, revised and enlarged edition. Pp. 298. 1940. Moscow and Leningrad: Metallurgizdat. (10.50 Rbl.)

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The effect of high pressures on the properties of copper alloys during crystallization. A. A. Bochvar, I. P. Velichko and Yu. A. Velichko. *Bull. acad. sci. URSS, S. S., Classe sci. tech.* 1940, No. 5, 13-24.—The effect of pressure during crystn. on the mech. properties and d. of Sn and Si bronzes was investigated. The strength, plasticity and d. can be increased considerably by crystg. under pressures of 1-10 atm. The rate of the increase becomes more gradual after the initial period of the application of pressure. For practical purposes a pressure of 7 atm. is sufficient. The effect is due to a better sath. of the ingots and to the suppression of the evolution of gas, but not to changes in the crystn. lattices. Increasing the content of Sn in bronzes increases at first the effect of higher pressures (together with the increase of the temp. interval of crystn.). This effect decreases with the isothermal stage of the crystn. A max. effect is obtained in the crystn. of bronzes contg. 7% of Sn, which, on pouring into sand molds, crystallize practically completely in a 1-phase solid soln. and have no isothermal stage of crystn. In crystn. under pressure the reverse liquation in Si bronzes is either reduced or avoided completely. This is proof of a close relation between the reverse liquation and the evolution of gas. Crystn. under pressure is recommended for the most important machine parts from Sn and Si bronzes. Porosity is avoided by crystn. under pressure. Seven references. W. R. H.

Inst. Metallurgy, AS USSR

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The effect of the crystallization of alloys under pressure, depending on the composition of the alloys. A. A. Bochvar. *Bull. acad. sci. U. R. S. S., Classe sci. math.* 1940, No. 1, 27-30.—Crystn. under pressure is most effective for decreasing porosity and flaws in metals of such compn. that the temp. changes during the course of crystn. In metals that crystallize at const. temp., flaws are eliminated only by extremely high pressure, not by pressures of a few atm. W. R. Henn

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Relation between linear shrinkage and composition of alloys. A. A. Bochvar and V. I. Dobatkin. *Tsvetnye Metal.* 1940, No. 7, 36 ff.—App. and procedure for determining the contraction of alloys of Pb Sn system (99.9% pure) from liquid state to room temp. are described. Twelve alloys were investigated with Sn varying from 0 to 100%. Each alloy was cast from temps. 100° above its liquidus and the linear changes were recorded. As the Sn increases, the contraction decreases at a diminishing rate until a compn. is reached slightly beyond the point of max. soly. of Sn at the eutectic temp., about 30% Sn; with further increases in the two-phase region, the contraction drops slightly along a straight line to about 90% Sn line, then increases again along a curve. The fact that the limits of straight-line relationship of contraction to composition do not coincide with the soly. limits is in accord with the theory previously proposed. B. N. Daniloff

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On the Efficiency of the Method of the Crystallization Under Pressure for Various Alloys. A. A. Bochvar (*Sbornik Nauch. Trudov Moskov. Inst. Tsvet. Metallov Zoloto*, 1948, (8), 14-21).—[In Russian]. Shrinkage porosity in alloys having a narrow solidification range (up to 10° C.), *i.e.*, eutectic Silumin, 10% "aluminium bronze," and pure metals, is usually of a conc. type. Alloys having a wide solidification interval (up to 70°-140° C.), *i.e.*, aluminium-4% copper, aluminium-1-2% silicon, and copper-5-8% tin, give a dispersed type of shrinkage porosity. Intermediate cases are possible.

—N. A.

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The role of distortion inside the crystal lattice during packing. A. A. Bochvar and I. Kel'berin. *Bull. acad. sci. U. R. S. S., Classe sci. tech.* 1940, No. 8, 31-3.—Distortion was obtained by deforming cast solid solns. (5% Sn in Cu, 8% Al in Cu and 16% Ni and 10% Zn in Cu) by cooling them from the fused state and obtaining a stratified dendrite structure with various concns. near the axes and in the intra-axial spaces. The nonuniformity of the soln. does not retard the displacement and the lines of the displacement cross the dendrite axes and the intra-axial spaces without changing their direction. In all cases the displacements are distributed uniformly along the enriched and the poorer regions (with respect to the dissolved substance) of the grains (crystallites). The difference in the strength of the individual parts of crystallites which existed in the grain, owing to the nonuniformity of the concn. and the increase in the resistance to distortion in the region of the distorted lattice cannot produce a sufficient impediment for the distribution of the displacement along the whole crystallite grain. The packing taking place is insufficient to compensate for the concn. of the tension at the places of the displacement. As compared with the packing effect of the dividing surfaces between the grains (crystallites) or between the grains and inclusions of other phases the packing effect of the distortions in the inner layers of the lattice is so small that it cannot retard the displacements begun in the weakest part of the crystallite.

W. R. Henn

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*On the Tendency of Aluminium Alloys to Cracking Under Shrinkage Stresses. A. A. Bochvar and M. K. Khakimdzhanova (*Sbornik Nauch. Trudov Moskov. Inst. Tsvet. Metallov Zolota* (*Collected Scientific Works of the Moscow Institute for Non-Ferrous Metals and Gold*), 1949, (8), 39–45).—[In Russian]. By a method developed by B. and K., aluminium–silicon alloys containing 2, 4, 6, 8, 10, and 12% silicon, and aluminium–copper alloys containing 4, 8, and 12% copper, and pure aluminium (99·5%) were investigated. The effect of the modification treatment of Silumin and the effect of iron on shrinkage cracking were also studied. The tendency of the aluminium–silicon alloys towards shrinkage cracking sharply decreases with an increasing silicon content. Modification by salts has no effect, while modification by sodium increases the tendency to shrinkage cracks. Iron markedly increases the tendency to shrinkage cracking in low-silicon alloys, has less effect on medium-silicon alloys, and no effect on eutectic alloys. In aluminium–copper alloys, copper slightly reduces the tendency to shrinkage cracking.—N. A.

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ELIMINATION OF THE FALLING METLA STREAM (IN CASTING) A.A. BOCHVAR AND A. G. SPASSKY (SBORNIK NAUCH. TRUDOV MOSKOV. INST. TSVET. METALLOV ZOLOTA 1940, (8), 45-51 (In Russian) A mould is filled by sucating in it a partial vacuum and drawing inliquid metal, or by forcing the oiquid metal with compressed air through a tube into the mould, followed bty solidification under pressure. B. and S. suppest an apparatus for this purpose and duscuss the ad vantages of the method. NA

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THEORY OF THE SHRINKAGE PHENOMENA IN ALLOYS. A.A. BOCHVAR AND O. S. ZHADAEVA (SBORNIK NAUCH. TRUDOV MOSKOV. INST. TSVET. METALLOV ZOLOTA, 1940 (9), 534-545) (In Russian) An attempt is made to develop a theory of the relationship between linear shrinkage and the lloy composition for various types of binary systems. N.A.

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m.a.

2.

*The Relation Between the Soundness of Cast [Aluminium Alloy] Pieces and Their Crystallization Interval. A. A. Bochvar and V. A. Sviderskaya (*Liteynoe Delo (Foundry Practice)*, 1940, 11, (11-12), 7-8; *Chem. Zentr.*, 1942, 113, (1-799; *C. Abs.*, 1943, 37, 2096).—[In Russian.] On cast pieces 93 × 63 × 25 mm. of aluminium-silicon and aluminium-copper alloys, the relation between soundness and temperature interval of primary crystallization was determined with a hydraulic press. The influence of composition was also investigated. Aluminium-silicon alloys with 0·3, 0·8, 1·1, 1·6, 1·9, 6, 12, and 18% silicon and aluminium-copper alloys with 0, 2, 4, 5, 8, and 14% copper were used. 1·5 mm. layers were machined off from two opposite faces, and the pieces were subjected to pressures up to 50 atmospheres in a hydraulic press until leaks developed. When the leak showed, the remaining thickness was measured and the pressure registered. The experiments confirmed existing theories.

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S

THE CAS ING PROPERTIES OF (ALUMINIUM) ALLOYS. A.A.BOCHVAR (SBORNIK. NAUCH. DOKLADOV SEKTSII METALLOVEDENIYA I TERMICH. OBRABOTKI VNITO METAL. LURG 1940, 35-59; Khim. Refera t. Zhur., 1941, 4, (2) 76; C.Abs., 1943, 37 3384) (InRussian) A detailed study of two casting properties 9solidifica- tion and formation of cracks) of eutectic alloys (alum inium-silicon and a luminium-copper)during cas ting under pressure and without pressure has revealed a close relation between the casting behaviour and the equilibrium diagram. The crack-forming property in alloys of the systems investigated decreases inversely with the content of the alloying addition.

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1ST AND 2ND ORDERS

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The Effects of Lead, Iron, Tin, Zinc, Nickel, Phosphorus, and Silicon Additions on Aluminium Bronze. A. A. Bochvar, V. D. Turkin, and M. V. Zakharov (*Tsvet. Met.*, 1941, (5), 28–31; *Alum. Referat. Zhur.*, 1941, 4, (9), 101; *C. Abs.*, 1944, 38, 1460).—[In Russian.] The effects of additions of lead (1·5–2·0%), iron (1·5–2·0%), tin (up to 0·5%), zinc (up to 0·5%), nickel (up to 1·0%), phosphorus (up to 0·2%), and silicon (up to 0·5%) on aluminium bronzes containing 6·0–9·5% aluminium were studied by determinations of the mechanical properties and examination of the behaviour of the alloys on cutting.

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2

Theory of the Shrinkage of Non-Ferrous Alloys. A. A. Bochvar and O. S. Shadaeva (*Liteynoe Delo*, 1941, **12**, (5), 5-8; *Chem. Zentr.*, 1943, **114**, (1), 203; *C. Abs.*, 1944, **38**, 3942).—[In Russian.] The literature on shrinkage in certain metallic systems is reviewed and contradictions pointed out. A relation has been established between the variation in the shrinkage of alloys of a given system and its phase diagram. The slope of the casting-shrinkage curve for metallic systems which form a eutectic of almost pure components is the same as for cases of the formation of an uninterrupted series of solid solutions. The manner in which the shrinkage in casting depends upon the composition of the alloys in systems with complicated phase transitions is discussed. The relations between the phase diagrams and the shrinkage for the systems lead-tin and tin-zinc are dealt with.

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BOCHVAR, A.A.

C A

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Zinc-containing silumins. A. A. Bochvar, A. A. Vashchenko, S. G. Glazunov, O. S. Shadaeva, A. M. Korolkov, K. I. Portnoi, E. M. Savitskii, and Z. A. Sviderskaya. *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1943, No. 9/10, 3-20.—Al alloys contg. Zn 8-15, Si 5-8, Cu less than 0.6, Mg less than 0.2, and Mn 0.4-0.8% (the amt. of Mn varying according to the amt. of incidentally introduced Fe) consist mainly of a Zn-Al solid soln. and its eutectic mixt. with Si. Si crystals appear at Si content greater than 8.5%. Cu is present as $CuAl_2$. The hardness of these constituents is detd. The alloys have d. 2.94-2.97, heat capacity 0.211, thermal expansion 0-250° 24.4 × 10^{-6}, liquidus temp. 575°, solidus temp. 545°. The ultimate tensile strength (U.T.S.) of cast alloys is almost independent of the Si content; it increases from 16 kg./sq. mm. at 6% of Zn to 23 kg./sq. mm. at 15% of Zn. Annealing for 2 hrs. at 100-300° does not raise U.T.S. The U.T.S. at 100-300° is similar to that of ordinary silumin. The total elongation of cast alloys is slightly reduced when Si content increases; it is lowered from 7-13% for Zn 6% to 1-3% for Zn 15%. Annealing at 150-80° raises it; at 300° it is 6 times that at 20°. Hardness of quenched alloys increases on keeping at room temp. The alloys expand irreversibly at approx. 250°, but this expansion is reduced by annealing at 150-200°. Cu and Mg raise the hardness of Al-Si-Zn alloys. Castability of these alloys is as good as that of silumins. They can be welded without losing their strength. B. A.

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M

Types of Contraction Cavities in Alloy Castings Due to Restricted Feeding. A. A. Roshvar (*Izvest. Akad. Nauk S.S.S.R.*, **1943**, [Tekhn.], (8), 50-56; *Brit. Abs.*, **1945**, [B I], 40).—[In Russian.] Cavities near the surface of alloy castings, especially of those having a complicated shape, are often due to contraction in the course of cooling. The conditions are considered in which this contraction cannot be fed by a fresh supply of molten metal or by a uniform shrinkage of the casting. Unlike cavities created by gas, these cavities are accentuated by warming and drying the mould.

Inst. of Machine Studies, AS USSR.

Ministry of Non-Ferrous Metals and Gold.

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M

2

Microstructure of Hypo-Eutectic and Hyper-Eutectic Alloys of Real Systems. A. A. Bochvar and O. S. Zhadaeva (*Izvest. Akad. Nauk S.S.S.R.*, 1944, [Tekhn.], 293–304; *C. Abs.*, 1945, **39**, 2277).—[In Russian.] Alloys of the following systems were studied: aluminium–silicon (unmodified), aluminium–silicon (modified), zinc–cadmium, tin–bismuth, lead–bismuth, and lead–antimony. Similar structures were observed on rapid and on slow cooling of the alloys; on slow cooling, all the structures were more clearly defined. In agreement with Bochvar's theory (*Z. anorg. Chem.*, 1934, **220**, 334; *Met. Abs.*, 1935, **2**, 471) two primary phases in the eutectic-type alloys were observed simultaneously in both the rapidly and the slowly cooled alloys. The minimum total number of primary crystals of both types was observed in the pure eutectic alloy, on both sides of which the number of primary crystals increased sharply at least in one of the phases. Pure eutectic alloys can be regarded as those in which the probability of the formation of primary crystals is the same for both phases. In the hypo-eutectic alloys the possibility of the formation of one phase is greater; in the hyper-eutectic alloys, that of the other. The centres of primary crystallization of both phases are present in both kinds of alloys. The crystallization of one of the primary phases can result in a sharp increase in the possibility of the formation of primary crystals of the second phase. This is connected with the minimum possibility of the formation of primary crystals in pure eutectic alloys. It is supposed that pure eutectic alloys possess a minimum capacity for spontaneous crystallization and a maximum tendency to supercooling.

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Min. of Non-Ferrous Metals and Gold.

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3RD AND 4TH ORDERS

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New Methods of Precise Representation of the Composition of Multicomponent Systems on a Plane. A. A. Bochvar, Henry Brutcher (Altadena, Calif.), Translation No. 2073, 1948, 10 pages. From *Bulletin de l'Academie des Sciences de l'URSS, Classe d. Sci. Tech.*, no. 12, 1944, p. 851-857.

Discusses previous methods. Describes 2 new methods and gives examples of their application. Points out applicability to systems containing more than 4 components and illustrates this with an example.

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The temperature curve of the beginning of linear shrinkage of binary alloys. A. A. Bochvar and V. I. Dobatkin. *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1945, 3 6... Al-Mg and Al-Si were studied in the 3 regions of the diagrams from pure metals to the eutectic concns. Al-23% Mg, Mg-32% Al, and Al-11.7% Si. In all regions the linear-shrinkage curve had a sharp break corresponding to the intersection of the curve with the eutectic horizontal (crit. point). The expt. values of the positions of crit. points, the solv. under nonequil. conditions of rapid cooling, and the calcd. crit. ratios of phases of the systems Al-Mg, Al-Si, and Mg-Al were, resp.: at Mg 20%, ~ 0.8%, and ~ 45%; at Si 2.7%, ~ 0.45%, and ~ 10%; at Al 12%, ~ 5-6%, and ~ 25%. The high values of the crit. ratio of phases in Al-Mg alloys is attributed to the special character of the crystn. of these alloys, resulting in the rapid formation of complete crystal lattices when the quantity of the liquid is still very large. This is confirmed by microscopic examn. of the alloys. In the system Al-Mg up to 20% of Mg there is observed a cluster of dendrite branches in all directions despite the presence of a considerable quality of the 2nd phase in the form of isolated inclusions, resembling little the eutectic structure. At Mg contents above 20%, the quantity of the liquid phase is so great that the branches of primary dendrites at all temps. above the eutectic remain sepd. until the end of the crystn. of dendrites. Therefore, alloys cont'g. 20% of Mg or more show no shrinkage up to the eutectic temp. The character of the distribution of the Al-Si eutectic along the boundaries of the dendrite branches explains the low value of the crit. ratio for this system, as compared with the Al-Mg system. At 1.1% Si, the dendrites of the Al solid soln. are sepd. in a no. of places by inclusions of the eutectic. At 1.7% Si this sepn. is nearly complete, and at higher concns. it is complete. 3 references.

W. R. Hess

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PROCESSES AND PROPERTIES INDEX

Dilatometric investigation of pure zinc. A. A. Bochvar and Z. A. Svidersskaya (Inst. Machine Knowledge, Acad. Sci. U.S.S.R.). *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1945, 229-11.—Repeated heating from room temp. to the m.p. of the zinc sample of freshly cast Zn paired with a standard of pure Al decreased the slope of the dilatometric curve from 40-50° to 15-20°. The slope of the curves decreased only after repeated heating (at 400°) of samples subjected to some deformation. This change in the slope of the dilatometric curve was caused by recrystn. taking place during the heating process. The monocrystal of Zn possesses various coeffs. of expansion, depending on the direction with respect to the main axis of the hexagonal prism (at 20-400° 59 × 10^{-6} in the direction parallel to the main axis and 16 × 10^{-6} in the direction perpendicular to the main axis. It is supposed that in polycryst. Zn samples the change in the coeff. of linear expansion is connected also with the change in the crystallographic orientation. The initial orientation is such that the volumetric changes taking place on heating the sample are chiefly in the direction close to parallel with respect to the main axes of hexagonal crystals and the coeff. of linear expansion of Zn exceeds considerably that of Al whose coeff. of linear expansion at 0-300° is 25 × 10^{-6}. As a result, dilatometric curves form a large angle of the slope with the horizontal. The sharp changes in the shape of the dilatometric curve on heating can be used as an indirect criterion of the hexagonality of the lattice of the principal phase at the given temp. 3 references.

W. R. Henn

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Superplasticity in zinc-aluminum alloys. A. A. Bochvar and Z. A. Svidirskaya. *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1945, 821-4(in Russian); cf. *C.A.* 41, 1589e.—Alloys with 75-85% Zn quenched in water after 2 hrs. at 375-400° show unusually low hardness as compared with both higher-Zn and lower-Zn alloys, at all temps. from room to 400°; e.g., 80% Zn, load 3 kg., diam. of ball 2.5 mm., at room temp., 150, 300°, Brinell hardness H = 30, 7, 1 kg./sq. mm., resp. A further anomaly appears beyond 300°, H rises to a max. of about 5 at about 330° and falls again on further rising temp.; this max. corresponds to eutectoid transition and is linked with formation of the β-solid soln. Both the abnormally low H and the max. at 330° are absent when the quenching is done from a temp. lower than 300°. All 3 H isotherms at 20, 100, and 300°, over the whole range of compn. of alloys, all quenched after 2 hrs. at 375° show a min. at about 18-20% Al, max. at 50%; the latter is very nearly the same (H = 85 kg./sq. mm.) at 20 and at 100° but much lower (H = 15) at 300°; the min. H falls from 42 to 15 to 1 at 20-100-300°. The superplastic alloy cannot be a mixt. of solid solns. of Al and Zn. It is seen that in a definite structural condition, the nature of which is as yet unclear, an alloy can be considerably softer than its components. Rupture tests of the softest alloy, including detn. of tensile strength, elongation, and contraction, at 300°, exclude the possibility of softening through vol. change and porosity, and confirm actual abnormally high plasticity.

N. Thon

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Investigation of structural components of cast aluminum copper and aluminum-silicon binary alloys by the micro hardness method. A. A. Bochvar and O. S. Zhadaeva. *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1945, 1080-92. Microhardness detns. were made on primary crystals of Al-Cu and Al-Si solid solns. to test the contention, based on thermodynamic considerations of crystn., that in a solid soln. not in a state of equil., the concn. depends on the compn. of the alloy. The concn. was judged by the hardness. As Cu increased in Al-Cu from 5.5 to 28%, hardness increased from 72 to 150. In Al-Si, increase of Si from 3 to 20% was accompanied by increase in hardness from 64 to 92. After Al-Cu had been heated for 10-18 hrs. at 540°, the values for hardness of samples contg. 5.5, 15.0, and 28% Cu were 130.5, 154, and 170, resp. The microhardness method offers a valuable criterion for studying alloys. M. Hosch

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3RD AND 4TH ORDERS

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*Micro-Hardness Study of the Structure of Cast Aluminium Copper and Aluminium Silicon Alloys. A. A. Bochvar and O. S. Zhadaeva (*Izvest. Akad. Nauk S.S.S.R.*, 1948, [Tekhn.], (10 II), 1089–1092). [In Russian] It is shown that the hardness of the crystals of primary solid solution in the region of the eutectic is not uniform, but depends on composition. The variation is reduced by homogenization but is not entirely eradicated.—N. A.

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Dependence of mechanical properties of alloys on their composition and structure. A. A. Bochvar. *Bull. acad. sci. U.R.S.S., Chim. sci.* (*Izv. Akad. Nauk SSSR, Otdel. Khim. Nauk*) 1946, 1, 53. Property-compn. diagrams of binary alloys are subject to radical change of shape at higher temp. In the Cu-Ni system, the max. of hardness is shifted and flattened at 500°; it is expected that above 600° the curve may become concave instead of convex. The increased resistance to shear owing to insertion of extraneous atoms into the lattice of a metal diminishes with rising temp. Additivity and linear relation between hardness and compn. in systems with a solid-soly. gap, as postulated by Kirnakov (*C.A.* 3, 303) is contradicted by the example of Al-Si in which the actual hardness, at any compn., lies far above the straight line. In other systems, linearity is found at ordinary temp. but does not hold at higher temps. It has been shown that at various compns. in a binary system not only does the hardness of the alloy vary but also the inter-hardness of the constituent phases; this is so even after homogenization. In Al-Zn, hardness is several times lower than in any single component, and plasticities are several times higher. Thus, the 80% Zn-20% Al alloy at 120° was deformed even by a dilatometer spring which had no effect on Pb. With rising temp., the hardness of that particular alloy decreases much faster than that of all other alloys, reaching at 250-300° negligible values of 0.5-0.6 kg./sq. mm. as against 8-10 kg./sq. mm. for the pure components. Plasticity is unusually high, as shown by an elongation of several hundred % and cross-section stricture of nearly 100%. Hardness-lowering and plasticity-raising effects of such abnormal magnitude are only found in cast polycryst. 2-phase alloys quenched from a high temp. and tempered. As the usual intragranular dislocation mechanism cannot account for the fact that the mixt. has a much higher plasticity than its more plastic component, an explanation must be sought in intergranular shears at the boundaries of phases. Alternatively, the phenomenon may be interpreted by changes in mutual soly. at grain boundaries with varying temp., which affects the ease of intergranular displacement. In general, healing of shear rifts through mutual soln., proper to mixts. and absent in pure solids, is apt to account for the appearance of enhanced plasticity in binary 2-phase solids. That the effect was found only in Al-Zn alloys may be related to the particularly pronounced temp. variation of mutual solid soly. in this system. Evaluation of mech. properties of an alloy must involve consideration of its structure not only in the sense of constituent phases but also with regard to the "metal plankton" consisting of heterogeneous particles suspended in the grain and responsible for many peculiarities of its mech. behavior. N. Thon

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Car

9

Effect of the type and range of crystallization on the mobility of the liquid metal between growing crystals. A. A. Bochvar and V. V. Kurina (M. I. Kalinin Inst. Non Ferrous Metals, Moscow). *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1946, 1459-63. - Al-Cu alloys with 0, 5, 12, 33, and 54% Cu were fused and the amt. of liquid metal L capable of being poured out from the crucible after definite time intervals s, corresponding to known fractions of the total time of complete solidification Z, was detd.; with 500 g. samples Z was of the order of 1.5-8 min. At equal s, the amt. L decreases in the order of Cu content of 54, 33, 12, 0, 12%. The curve for pure Al actually crosses that for 12% Cu; for the latter alloy Z is less than for Al. The behavior appears even more strikingly from plots of L against s/Z. The ideal curve corresponding to const. rate of crystn. would be a straight line but actual curves are convex to the s/Z axis and follow the order by decreasing L for equal s/Z 54, 33, 0, 12, 5% Cu. The latter alloy yields practically no liquid after 2.5 min. (s/Z = 0.28); at the same stage, the amts. of liquid poured from 500 g. of 12, 0, 33, 54% Cu, are 100, 200, 205, 295 g., resp. The difference between the theoretical and the actual L measures the amt. P of liquid imprisoned between crystals. The reason for the high P of the 5 and the 12% Cu alloys lies in the incongruence of the crystn. at those compns. owing to which only part of the liquid atoms are eligible for crystn. This makes for thinner and more richly branching dendrites than in eutectics or pure metals, hence for narrower channels and larger P.

N. Thon

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M

Non-Ferrous Alloys Used in War-Time Germany. A. A. Bochvar (*Tsvet. Metally*, 1946, (3), 40-54). [In Russian]. A review of copper, aluminium, and zinc alloys.—N. A.

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Dependence of the Mechanical Properties of Alloys on Their Composition and Crystal Structure. A. A. Bochvar. *Bulletin of the Academy of Sciences of U.S.S.R.* (Section of Technical Sciences), no. 5, 1946, p. 743-753.

Reviews basic theories. Dependence is much more intricate than it appears. Recommends use of electron microscopy, X-ray investigation, and the determination of mechanical and physical properties of metals in microscopic or even ultra-microscopic sizes to increase present knowledge.

Evaluation B-78945

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*The Study of Casting Systems by Means of Models. A. A. Bochvar, E. M. Notkin, S. I. Spektorova, and N. M. Sadchikova (*Izvest. Akad. Nauk S.S.S.R.*, 1948, (Tekhn.), (6), 875–882).—[In Russian]. A new method of making models of complicated castings has been introduced, using transparent organic material for the mould. A study of the effect of the cross-sections of the principal parts of the casting (run from below and also by means of a vertical gate) has shown that the rate of filling the mould depends chiefly on the cross-section of the gate. The separation of oxides and slag depends on the cross-section of the gate and on the shape and size of the arrangement for entrapping them. With increase in the dia. of the gate, the time of filling the mould is reduced, but turbulence and the quantity of oxides and slag carried over increase markedly. With gates and risers of small dimensions, the vertical-gate system ensures filling of the mould layer upon layer, which is an important advantage over the method of casting from below from the point of view of directionality of crystallization. Further study must be directed to the evolution of casting systems in which improved separation of oxides and slags would be achieved without reduction of the rate of filling the mould.

N.A.

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On the Question of the Abnormally High Plasticity of Certain Zinc Aluminium Alloys. A. A. Bochvar and Z. A. Sviridenkaya (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (7), 1001–1004).—[In Russian]. Zinc-aluminium alloys containing 75–85% zinc, on heating to 100°–300° C. after preliminary quenching, become many times softer and more plastic than the pure component metals and the alloys containing 0–75 and 85–100% zinc, heated to similar temp. The unusual increase in plasticity is observed with a granular structure but not with a lamellar one. The following explanation of the phenomenon is given. Plasticity depends on the mechanism of deformation, on the initial capacity for deformation, and on the possibility of this capacity being restored during the deformation process by the removal of work hardening and the "healing" of sub-microscopic sources of failure which arise in deformation. If there is a sufficiently large mutual solubility of the component elements of the alloy and one which changes rapidly with temp., mutual solution takes place on account of the local increase in temp., and the reverse process of separation occurs on cooling. In this way, as a result of the transference of atoms through the solution, "healing" of the sites of incipient failure can take place.—N. A.

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The Effect of the Character of the Crystallization Process and the Crystallization Interval on the Movement of Liquid Metal Between the Growing Crystals. A. A. Bochvar and V. V. Kuzina (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (10), 1459–1462).—[In Russian]. The problem was investigated by a method which consisted of pouring off the molten alloy after it had been cooled to the liquidus temp. and then held in a state of crystallization for a period equal to that which had been determined as necessary for complete

solidification. The mother liquor poured of f and the solid metal remaining in the crucible were weighed2and in thaa way the movement of the liquid metal amont the growing crysta ls was determined. Experiments were carried out of commercial aluminium and aluminium alloys containing 5, 12, 33, and 54% copper. The mo vement of liquid metal was found to be greater in eutectic alloys and intermetallic compounds than in solid s lutions. NA

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C-2 Organic, Ours & App.

/ 869. **Application of substances with high internal pressure to analysis of hydrocarbon mixtures.** A. A. Bocharov and R. D. Obolentsev (*J. appl. Chem., USSR*, 1946, 19, 492—503).—Differences in internal pressure of different hydrocarbons may be shown by variations of the crit. solubility temp. of SnI_4 in the hydrocarbons. The isomers of hexane, heptane, and octane all have a characteristic max. val., the "tin point". A method is indicated for the quant. analysis of 3-component mixtures of isomeric hydrocarbons by the use of the "tin point" in conjunction with qual. spectrum analysis and determination of the methyl no. by infra-red spectroscopy.

E. B. Uvarov.

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The variation of the microhardness of metals in relation to the depth of penetration of the indenter and to the condition of the surface layer. A. A. Bochvar and O. S. Zhadaeva. *Bull. acad. sci. U.R.S.S., Cl. sci. tech.* 1947, 341-8; cf. Schulz and Hanemann, *C.A.* 36, 3131[1] — The object of the work was to increase the precision of microhardness testing of metals and to investigate the work-hardening effect of polishing various metals and alloys. Tests were made on 99.98% Al, electrolytic Cu, remelted Zn single crystal, Sn, Pb, Cd, 32%-Zn α brass, and 42%-Zn β brass by using loads of 1, 2, 5, 10, 20, 50, and 100 g. on the Khrushchov and Berkovich app. with confirming tests on the Hanemann-Zeiss microhardness tester. Shiny surfaces suitable for testing were obtained on cast specimens by casting the melts on a polished slab. Mech. polishing was done on a file, emery paper, and by using Al_2O_3 on a polishing wheel. In plots of microhardness (kg./sq. mm.) *vs.* indenter load for all specimens and all conditions the hardness was found to increase to a max. and then to decrease with increasing load. Plots of microhardness *vs.* depth of the indent showed a similar behavior. The microhardness of a given metal tended to be lower in the cast condition than after mech. polishing or after the metal had been deformed and annealed. Electropolishing gave lower microhardness than did mech. polishing. It is concluded that if the microhardnesses of different metals are to be comparable, the indenter load must be high and the surface prepn. must be suitable. The standard diagonals of 5, 10, and 20 μ recommended by Schulz and Hanemann failed to give const. values when used with the present data. The factors that caused anomalous hardness values at low indenter loads are: (1) work-hardening of the surface layers produced by mech. polishing; (2) possible breaking up of the surface as a result of its mode of crystn., of surface oxidation, of deformation, or of recrystn.; (3) the difference in the stress condition of exterior and interior layers of metal in the microhardness-testing process. The data on microhardness *vs.* load are given in the table where the various specimens are identified by the nos.: (1) Al, cast, unpolished; (2) Al, cast, mech. polish; (3) Al, wrought, annealed 4 hrs. at 400°, unpolished; (4) Cu, cast, unpolished; (5) Cu, cast, mech. polish; (6) Cu, wrought, annealed 1 hr. at 700°, cleaned on emery paper, and electropolished; (7) Zn, cast, unpolished; (8) Zn, cast, mech. polish; (9) Sn, cast, unpolished; (10) Sn, cast, mech. polish; (11) Pb, cast, unpolished; (12) Pb, cast, mech. polish; (13) Cd, cast, unpolished; (14) Cd, cast, mech. polish; (15) α brass, wrought, annealed, electropolished; (16) same, except mech. polish; (17) β brass, wrought, water quenched after 3 hrs. at 850°, electropolished; (18) same, except mech. polish. A. G. Guy

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Expansion of some alloys on crystallization. A. A. Bochvar, Z. A. Svidersksya, and B. K. Korbut. *Bull. Acad. Sci. U.R.S.S., Classe sci. tech.* 1947, 409-17(in Russian).—The reality of the expansion taking place in the initial stages of crystn., prior to the final contraction, was confirmed and the effect found to be much greater than hitherto assumed. Measurements were made on samples 4 cm. long. Al-Zn alloys with 30, 60, 70, 75, 77, 78, 80, 90% Zn showed linear expansions ϵ = 0.13, 0.30, 0.58, 0.69, 0.94 (max.), 0.73, 0.40, 0%, resp. Thus, there is no simple direct relation between the magnitude of ϵ and the length of the crystn. interval. In Al-Mg alloys with 5, 10, 15, 25, 30, 50% Mg, ϵ = 0.175, 0.200, 0.330 (max.), 0.025, 0, 0% (av. of 3 detns. on 40-g. samples, casting temp. 100° above the liquidus temp.); the max. of ϵ lies between the compn. of max. crystn. interval and the eutectic compn. Similar results were found in Al-Cu alloys, 5, 10, 20% Cu, ϵ = 0.107, 0.157 (max.), 0.075%, and in Al-Si alloys, 2, 4, 6, 12% Si, ϵ = 0.05, 0.141 (max.), 0.116, 0.065%. The effect of the excess Δt of the casting temp. over the temp. t of the liquidus is illustrated by Al 85-Mg 15 (t = 570°); Δt = 0, 100, 150, 200°, ϵ = 0.262, 0.330, 0.500, 0.582%; thus, ϵ increases with superheating; Al 23-Zn 77 (t 487°) gives less consistent results, probably owing to evapn. of Zn and shift of compn. at high Δt. Satn. with H_2O vapor increased ϵ 2-3 times in Al-Si with 2-6% Si. Pure Sn, Zn, Pb, Mg, and Bi show no ϵ. With pure Al, cast at 700 and 760°, small ϵ effects (0.050 and 0.025%, resp.) were observed reproducibly; this may be due to the particularly strong tendency of Al to dendritic crystn.; the absence of ϵ in Bi is striking and is no doubt due to compensation of expansion by a change of the level of the liquid metal in the isothermal process; the same explanation applies to the absence of ϵ in eutectic alloys. However, both pure Bi and eutectic alloys do show a slight ϵ if the free surface of the cast is frozen by application of a massive plate. Forewarming of the die and other devices results in slower cooling and decreases ϵ somewhat. In Al 23-Zn 77 and in Al 85-Mg 15, the expansion takes place in the temp. interval 460-400° and 505-470°, resp., i.e. always in the region between the liquidus and the solidus.

N. Thon

Evaluation B-78945

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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PROCESSES AND PROPERTIES INDEX

12

B

Dependence of the Heat Resistance of Aluminum Alloys on Their Composition and Structure. (In Russian.) A. A. Bochvar, *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Oct. 1947, p. 1369-1384.

A rapid auxiliary method for high-temperature performance determination is proposed, based on the gradual change, with time of loading, of the size of impressions obtained by forcing a macro- or microindenter under constant load into the specimen. On the basis of data obtained by the above method and also by standard creep testing, it is believed that the heat resistance of alloys results from heterogeneity of their crystal structures, and also may be caused by the formation of screen- or skeleton-like inclusions of solid phases on the grain boundaries.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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BOCHVAR, A. A.

PA 1T33

Mar 1947

USSR/Alloys
Castings
Aluminum

"Damage to Castings Due to Shrinkage Stresses During the Crystallization Period and Its Correlation with the Composition of the Alloy," A A Bochvar and S A Sviderskaya, 8 pp

"Izvestiya Akademii Nauk USSR, Otd Tekh" No 3

Aluminum-copper and aluminum-silicon alloys investigated.

1T33

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

BOCHVAR, A. A.

PA 1T34

USSR/Metals - Hardness Mar 1947

"On the Variation of the 'Microhardness" of Metals with the Depth of Penetration of the Indentor and with the Condition of the Surface Layer," A A Bochvar and O S Zhadayeva, 8 pp

"Izvestiya Akademii Nauk USSR, Otd Tekh" No 3

Aluminum, copper, zinc, tin, lead, cadmium, brass investigated.

1T34

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7"

"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

BOCHVAR, A. A.

Apr 1947

USSR/Crystallization
Alloys

"Contribution to the Question of Expansion of Some Alloys During Crystallization," A. A. Bochvar, Z. A. Sviderskaya, E. K. Korboot, 10 pp

"Izv Ak Nauk Tekh Nauk" No 4

Graphs showing the dependence of expansion upon percentage composition of Zn and Mg and temperature. Tables showing expansion of various aluminum alloys at various temperatures, compositions, etc.

9T100

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7"

"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

BOCHVAR, A. A.

PA 9T101

USSR/Crystal Structures
Micro-hardness Tests

Apr 1947

"The Distribution of Micro-hardness Values Within the Limits of One Crystal Grain of Metal," A. A. Bochvar, O. S. Zhadayeva, 6 pp

"Izv Ak Nauk Tekh Nauk" No 4

Microphotographs of crystals. Graphs showing the interdependence of the location of pressure and the micro-hardness of crystals.

9T101

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7"

"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

BOCHVAR, A. A. ACAD. PA40T70

USSR/Metallurgy Oct 1947
Aluminum Alloys, High Temperature
Alloys

"Relation of the Heat Resistance of Aluminum Alloys to Their Composition and Structure," Academician A. A. Bochvar, 15½ pp

"Izv Ak Nauk SSSR, Otdel Tekh Nauk" No 10

Suggests auxiliary method of determining the heat resistance quality of aluminum alloys and discusses reasons for alloys having individual resistance to heat within the range of 250 - 300°. Makes his recommendations on basis of data already available. Reports results of experiments conducted on various aluminum alloys at temperatures of 200, 300, 350, and 400°. [redacted] 40T70

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BOCHVAR, A. A.

In POWDER METALLOGRAPHY by M. YU. BAL'SHIN, the following mention of A. A. BOCHVAR is made in the bibliography and sources (Poroshkovoye Metallovedeniye, pp. 1-332, 1948):

a) BOCHVAR, A. A., Osnovy termicheskoy obrabotki splavov (Fundamentals of the Heat-Treatment of Alloys), Isvetmetizidat, 1932
b) BOCHVAR, A. A., Metallovedeniye (Metallography), Metallurgizdat, 1945.
c) BOCHVAR, A. A., ZhRMO, 1927
d) BOCHVAR, A. A., and Zhadayeva, O. S., Liteynoye delo (The Foundry Industry) No. 5, 1941
e) BOCHVAR, A. A. and Sviderskaya, Z. A., Izvestiya OTN AN SSSR, No. 9, 1945.
f) BOCHVAR, A. A., Isvestiya OTN AN SSSR, No. 5, 1946.
g) BOCHVAR, A. A., Belov, N. M. and Granovskiy, A. A., Tsvetnyye metally (Nonferrous Metals), No. 3, page 86, 1936

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

PROCESSES AND PROPERTIES INDEX

13

Different Mechanisms of Plasticity in Metallic Alloys. (In Russian.) A. A. Bochvar. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), May 1948, p. 649-653.

Proposes a new approach for the explanation of the mechanism of plasticity of alloys at high temperatures, emphasizing the predominant influence of the character of the interaction of the existing phases of the heterogeneous system.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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USSR/Metals - Alloys, Structure Feb 52

"On the Solid-Liquid State of Alloys of Various Composition During the Period of Their Crystallization," Acad A. A. Bochvar, I. I. Novikov

"Iz Ak Nauk, Otdel Tekh Nauk" No 2, pp 217-224

Discusses dependence of essential casting characteristics of alloys, such as linear shrinkage, pre-shrinkage expansion, shrinkage stress, hot-shortness tendency to liquation, on length of temp interval of solid-liquid state, i.e., range between temp of shrinkage beginning and solidus, and on structure and mech properties of alloys in this state.

212T90

Analyzes "casting property-composition" diagram and emphasizes importance of investigation in field of solid-liquid state for certain technological processes as, e.g., ingotless rolling, forging alloys above solidus, obtaining fine powders from alloys, plastic in solid state, and by pulverizing them in solid-liquid state.

(CA 47 no.14:6846 '53)

212T90

BOCHVAR, A. A.
ACAD A. A. BOCHVAR

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USSR

Effect of Boundary Zones Containing Low-melting Components Upon the Results of Determining Heat Resistance of Alloys Subjected to Various Deformations

Izv. Akad. Nauk. Otd. Tekh. Nauk (2), 42-45 1954

A. A. Bochvar, M. E. Drits, L. S. Kadanof

U.S.S.R.

Tests were carried out to investigate discrepancies in the determination of heat resistance of alloys with Mg-base by tensile and hardness tests. Mg-Mn alloys with the additions of Cd, Zn and Pb were tested. Experimental results point to the negative effect of low-melting components upon heat resistance of binary alloys. Alloys containing low-melting components and having a cast structure with accentuated intracrystalline liquation develop considerable creep. This, however, cannot be detected by the method of consistent hardness. It is suggested that tensile test is always made after the consistent hardness test.

BI

Evaluation B-81524

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

The Influence of Additions [Iron and Silicon] on the High-Temperature Strength of Aluminium. A. A. Bochvar, Z. A. Sviderskaya, and L. M. Kychakova. [illegible] S.S.S.R., 1954, [Tekhn.], (2), 46-51. [In Russian.] The influence of Fe and Si on the high-temp. strength of Al was studied by measuring the Brinell hardness of cast and stabilized specimens at 300° C., in tests lasting from 30 sec. to 1 hr. The stabilization was effected by maintaining the specimens at 300° C. for 100 hr. Binary alloys of Al contg. up to 1% Fe or 0·5% Si, and ternary alloys contg. 99·7% Al and 0·3% (Fe + Si) or 99·5% Al and 0·5% (Fe + Si) were examined. The addn. of small amounts of Fe (0·05%) increased the high-temp. hardness of the alloy quite noticeably; the hardness continued to increase, reaching a value 3-4 times that of the Al at Fe concentrations of 0·3-0·6%. The effect of Si was smaller and became appreciable only in the 0·3-0·5% range. A study of the ternary alloys confirmed the dominant role of Fe in increasing the high-temp. strength of Al and showed that alloys contg. $FeAl_3$ (detected by microscopical analysis) possess max. hardness.—S. K. L.

Evaluation B-81745, 17 Jan 55

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

3

IRMC

Transl. No. & Country	Translation issud by A.E.R.E., Harwell	Authors
505 OT/1235 U.S.S.R.	On the Relation Between the Ratio of the Heat of Fusion to the Temperature of Fusion and the Atomic Number of the Elements Dokl. Akad. Nauk, 98(2), 227, 1954	A.A. Bochvar G.N. Kuznetsov MCH

NOTE: Application for this translation should be made to The Librarian, A.E.R.E., Harwell, Didcot, Berks.

Source: Index Aeronauticus, Vol 11, No. 11, November, 1955, p 131

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

Bochvar, Andrei A.; Metallovedenie (Me...

MT

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

On the Dependence of the Thermal Strength of Metallic Materials on their Composition. PA - 2163

developed surface can the ability of one or another component be completely utilized in order to increase the thermal strength of the melt. Neither the solid solution in itself nor the second phase in itself ensure high thermal strength of the melt, but only the joint occurrence of both phases.
(No illustrations)

ASSOCIATION Not given
PRESENTED BY
SUBMITTED 10. 9. 1956
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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

BOCHVAR, A.A.

24-11-2/31

AUTHORS: Bochvar, A. A. and Brovchenko, Ye. B. (Moscow)

TITLE: Effect of cyclic heat treatment in copper, nickel and some single-phase copper base solid solutions. (Effekt tsiklicheskoy termicheskoy obrabotki v medi, nikele i nekotorykh odnofaznykh tverdykh rastvorakh na mednoy osnove)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1957, No.11, pp.10-13 (USSR)

ABSTRACT: It has been pointed out in a number of papers (Refs.1-3) that cyclic heat treatment can change appreciably the dimensions and the shape of specimens of tested metals and finally lead to failure. The work described in this paper aimed at measuring the effects of cyclic heat treatment in certain pure metals with a cubic face centred lattice and of solid solutions of the substitution type of alloys based on such metals and having a crystal lattice of the same type. Pure copper and nickel and three types of copper base solid solutions were used in the experiments, namely, German silver MH-19, brass Л-68 and a ternary alloy (containing 64.6% C, 14.95% Ni, 20.2% Zn, 0.05% Fe and 0.03% Mn). The composition of the tested alloys is given in Table 1, p.11. The specimens were in

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Effect of cyclic heat treatment in copper, nickel and some single-phase copper base solid solutions. (Cont.) 24-11-2/31

the form of 5 mm thick sheet from which specimens of 100 x 25 mm were cut in the direction of rolling. The selection of the maximum temperatures of the cyclic heat treatment was based on the rule, which was confirmed, that an appreciable effect is obtained in the case of relatively small numbers (tens and hundreds) of cycles, only if an adequate mobility of the atoms is ensured by heating to temperatures of at least 0.5 times the absolute melting temperature for pure metals or the solidus temperature for alloys, i.e. a temperature which is considerably higher than the initial recrystallisation temperature. Typical curves of the changes in length, width and thickness are reproduced in Figs. 1 and 2, whilst Fig.3 shows the magnitude of the effect of cyclic heat treatment (100 cycles) on the change in length as a function of the maximum temperature for nickel, German silver (Cu-Ni) and the ternary copper-Ni-Zn alloy. There are 3 figures, 2 tables and 3 references, all of which are Slavic.

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

BOCHVAR, A.A.

"Development of Porosity in Uranium Under the Action of Cyclic Heat Treatment," by A. A. Bochvar and G. I. Tomson. Atomnaya Energiya, Vol 2, No 6, Jun 57, pp 520-524

The article describes a study of the behavior of uranium subjected to cyclic heat-treatment. Cycle duration was 50 seconds over the α-phase temperature region and also over the range of temperatures covering $\alpha \rightleftarrows \beta \rightleftarrows \gamma$ transitions. The following conclusions are drawn from the experiments:

"Substantial changes take place in uranium subjected to repeated fast changes in temperature in the α-phase region. In texturally deformed uranium, deformations have specific directions and porosity develops with a corresponding decrease in density. These changes appear after 250-1,000 cycles, or 3.5-14 hours of cyclic heat-treatment.

"Cyclic heat-treatment over two phase transitions causes extreme deformation of uranium samples. Porosity development with its corresponding decrease in density is considerably more intense than in the case of treatments in the α-phase." (U)

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SOV/137-58-10-21656

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 10, p 172 (USSR)

AUTHORS: Preobrazhenskaya, Yu.A., Bochvar, A.A.

TITLE: Heat-resistant Properties of Alloys as a Function of Preliminary Deformation and Heat Treatment (Zavisimost' zharoprochnosti splavov ot stepeni predvaritel'noy deformatsii i termicheskoy obrabotki)

PERIODICAL: Sb. nauchn. tr. Mosk. in-t tsvetn. met. i zolota, 1957, Nr 27, pp 268-281

ABSTRACT: Studies were undertaken in order to determine the effect of the degree of deformation and heat-treatment conditions on heat-resistant properties (HRP) of Al alloys (A). Binary Al A's with Cu, Fe, Mg, Si, and Ni were employed in the investigations, together with standard A's AL1, D16, AV, and Al specimens of various degrees of purity. Heat-resistance tests performed by the continuous-hardness (CH) method indicated that the advantage of a cast structure of an Al A is most apparent at temperatures of 250-300°C (0.65-0.7 of the fusion temperature, T_{mp}), whereas A's which have been deformed possess better strength characteristics at lower temperatures

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Heat-resistant Properties of Alloys (cont.)

(up to 0.5 of T_{mp}). At temperatures of the order of 0.85-0.9 T_{mp}, the CH values of all the A's investigated, regardless of their initial condition, are fairly close to each other. Deformation of pure metals results in a reduction of their creep-rupture behavior but has practically no effect on their CH. In the case of heterogeneous A's, the reduction of the CH begins with deformations of 15-20% and continues up to such severe deformations as 85-95%. The nature of changes occurring in the creep-rupture behavior with progressing deformation, to a considerable extent, is a function of the nature of the original cast structure. The creep-rupture strength of a cast substructure varies in a manner analogous to the variations in the CH, but originates at an earlier stage and progresses with greater intensity. If, however, a coarse network of excess metallic compounds which tend to produce embrittlement of the material is present in the A, the deformation may, at times, even have a favorable effect on the HRP of the A. Optimal HRP are exhibited by A's which contain within grains of their solid solutions a network of very fine deposits of secondary phases. Coagulation, coarsening of these precipitated particles, as well as their elimination, all tend to impair the HRP of the A. Structural changes which occur in the A's during deformation were studied on polished surfaces of a cut dividing a specimen into two equal sections. Both sections were clamped together, and indentation tests

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Heat-resistant Properties of Alloys (cont.)

were carried out in the zone of their junction. Slip lines were observed in the vicinity of the indentation at temperatures up to 400°. At low temperatures these lines were essentially rectilinear and changed their direction only in transition from one grain to another. As the temperature was increased, the slips occurred primarily along the boundaries of dendritic cells; curving of clip lines, formation of flexure bands, fragmentation, etc., also occurred at the same time. The effect of preliminary deformation on the HRP of the A's is connected with structural changes which consist not only in the disruption of the structural skeleton of excess metallic compounds which tends to obstruct the process of deformation, but primarily involve changes in the condition of surfaces separating the phases or the disruption of interphase bonds which facilitate the deformation of the basic constituent virtually independently of any inclusions that may be present.

E.K.

1. Aluminum alloys--Properties 2. Aluminum alloys--Thermodynamic properties
3. Aluminum alloys--Deformation 4. Aluminum alloys--Heat treatment

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"APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720008-7

BOCHVAR, A. A.

AUTHOR: BOCHVAR,A.A., NOVIK,P.K.

TITLE: ~~The Effect~~ of the Composition of Aluminium-Zinc Alloys on the Value of Size Variation of Specimens Subjected to Cyclic Thermal Treatment. (Vliyaniye sostava splavov alyuminiya s tsinkom na velichinu izmeneniy rasmerov obrastsov pri tsiklicheskoy termicheskoy obrabotke, Russian). PA - 2337

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol 112, Nr 5, pp 1041 - 1042 (U.S.S.R.).

Received: 4 / 1957 Reviewed: 5 / 1957

ABSTRACT: The cyclic thermal treatment of metals and alloys causes irreversible, directioned changes of the linear dimensions of the metallic workpieces. On the occasion of the investigation of the cyclic thermal treatment of Al-Zn-alloys, the authors noticed a strong influence of the composition of the alloy on the amount and even on the sign of the changes of the linear dimensions of the workpieces. The present paper supplies the most important results obtained.

The plane samples were cut out from rolled plates. The cyclic thermal treatment of the main series of the samples consisted in a quick heating to 340° between two massive plates, and cooling in water of 13° C. Each cycle lasted for 5 minutes.

On the occasion of the measuring of the dimensions after 20, 40

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PA - 2337

The Effect of the Composition of Aluminium-Zinc Alloys on the Value of Size Variation of Specimens Subjected to Cyclic Thermal Treatment.

and 40 cycles, the following results were obtained: 1) length and width of the samples of pure zinc increased and thickness decreased in the case of an increasing number of cycles. 2) In the case of an increase of the zinc content in the alloy from 0 to 30% the increase of length quickly diminished, and in the case of a zinc content of from 38 to 72 %, the dimensions of the samples practically did not change at all. 3) In the case of an increasing number of cycles the length and partly also the width of the samples with 78 to 95 % zinc decreased noticeably and thickness increased. The most important changes took place near the eutectoid concentration i.e. in alloys containing from 78 to 80 % zinc. Samples of the alloys with 98 % zinc showed the same qualitative changes as pure zinc. These data are illustrated by an attached diagram. The great differences between the changes of the dimensions of alloys and the samples of pure aluminium or zinc are obviously in connection with the fact that besides thermal tensions also phase shifting may exercise a strong influence on the deformation of the samples treated cyclically. The effects of thermal tensions and of the phase transitions superpose algebraically. Also phase transitions in connection with the reciprocal

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The Effect of the Composition of Aluminium-Zunc Alloys on the Value of Size Variation of Specimens Subjected to Cyclic Thermal Treatment. PA - 2337

solubility of the α- and ß-phases exercises a strong influence on the modification of dimensions. (1 illustration).

ASSOCIATION: not given.
PRESENTED BY:
SUBMITTED: 10.9.1956
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AUTHOR BOCHVAR A.A., Member of Academy, PREOBRAZHENSKAYA YU.A. PA - 3144

TITLE On the Nature of Slip Bands Visible in the Microscope.
(K voprosu o prirode vidimykh v mikroskop liniy sdviga -Russian)

PERIODICAL Doklady Akademii Nauk, 1957, Vol 113, Nr 3, pp 564-566 (U.S.S.R.)
Received 6/1957 Reviewed 7/1957

ABSTRACT The attempt was made to find out whether the so-called slip bands, at least at temperatures at which diffusion processes develop very slowly, are the only measure for plastic deformation. Investigations were carried out indirectly by comparing the quantities produced on the occasion of deformation of slipping traces in substances of different plastic properties. Steel G-14 (1,4% C, 14% Mn) was investigated. It is obvious that the essential part of plastic deformation, apart from visible slipping, is brought about by yet another process. Observations permit the following Hypothesis: initial deformation is caused by the displacement of the atoms in all or most parallel atom-planes that are suited for such displacements. In the case of a crystallographically orientated mass displacement of atoms the metal is consolidated. Where consolidation reaches a limit, a microdestruction takes place which extends to a considerable number of atom-planes and develops in the direction of slipping. A number of facts is enumerated in confirmation of this hypothesis. It may thus be concluded that the slip bands are not the only measure for plastic deformation by displacement, but domains of profound disturbances of the regular structure and probably also microfissures which may occasionally be so fine that they disappear by

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On the Nature of Slip Bands Visible in the Microscope.

polishing. If deformation goes further, part of the microfissures may be closed, but others will occur instead.
(With 4 illustrations and 4 citations from Slavic publications).

ASSOCIATION Moscow Institute for Colored Metals and Gold "M.L.KALININ".
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BOCHVAR, A. A.

AUTHORS: Bochvar, A. A., Academician
Brovchenko, Ye. B.,

20-1-19/42

TITLE: Modification of the Dimensions of Copper-Zinc Alloy Plates Under Cyclic Thermal Treatment (Izmeneniye razmerov plastin iz mednotsinkovykh splavov pri tsiklicheskoy termicheskoy obrabotke)

PERIODICAL: Doklady AN SSSR, 1957, Vol. 117, Nr 1, pp. 75-77 (USSR)

ABSTRACT: For the investigation of this modification the authors used foil from copper and its industrial alloys of brass type. The composition of these alloys are illustrated in a table; Out of the 5 mm thick foils samples were cut along the direction of rolling (1oo mm X 25 mm). For a comparison some samples cut out vertically to the rolling were investigated. The results in these two cases were practically the same. The heat treatment consisted of a warming up of the samples up to a maximum temperature of 56o° or 6oo° respectively lasting for 1o minutes. Then the samples were kept at a constant temperature for 2 minutes and then quickly cooled down in water of room temperature. The investigation of the microstructure and the examination of the mechanical properties gave evidence of the following: Already in the first warming up to the above given temperatures a recrystallization annealing of the rolled and previously not annealed

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samples took place. Therefore in a remarkable number of cycles practically no differences in the behaviour of the cold-rolled samples were ascertained, which had been chosen before and after the preceding annealing. Measuring the dimensions of the samples after 25, 100, 150, 200 cycles showed that with increasing number of the cycles the dimensions are gradually and usually linearly modified. The results of the measurings carried out after 100 cycles at $15^{\circ} \rightleftarrows 560^{\circ}$ are illustrated in a graph for all materials here investigated. The samples of the monophase alloys with cubical face-centered lattices continously grew longer and broader and became thinner at the same time. The influence of the cyclic heat treatment in intendified with increasing content of zinc in the alloy. Then the behaviour of the single alloys is discussed. The change of the sign of the effect of the cyclic heat treatment is obviously connected with the occurrence of the ß-phase in the alloy. The causes for this change of signs might be found by investigating alloys that consist of a pure ß-phase. There are 4 figures, 1 table, and 1 Slavic reference.

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Modification of the Dimensions of Copper-Zinc Alloy Plates Under Cyclic Thermal Treatment. 20-1-19/42

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BOCHVAR, A. A., KONOBEYEVSKIY, S. T., KUTAYTSEV, V. I., and CHEBOTAREV, N. T.

"Interaction Between Plutonium and Other Metals in Connection with their Arrangement in Mendeleev's Periodic Table."

paper to be presented at 2nd UN Intl. Conf. on the peaceful uses of Atomic Energy, Geneva, 1 - 13 Sept 58.

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