19 OCTOBER 1979 (FOUO 1/79) MEIMLL 1 OF 1

JPRS L/8723

19 October 1979

USSR Report

MATERIALS SCIENCE AND METALLURGY

(FOUO 1/79)

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

For further information on report content call (703) 351-2938 (economic); 3468 (political, sociological, military); 2726 (life sciences); 2725 (physical sciences).

JPRS L/8723

19 October 1979

USSR REPORT

MATERIALS SCIENCE AND METALLURGY

(FOUO 1/79)

This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

Photoreproductions of foreign-language sources may be obtained from the Photoduplication Service, Library of Congress, Washington, D. C. 20540. Requests should provide adequate identification both as to the source and the individual article(s) desired.

CONTENTS PAGE

Composite Materials

PHYSICAL CHEMISTRY OF COMPOSITE MATERIALS

Moscow FIZIKOKHIMIYA KOMPOZITSIONNYKH MATERIALOV in Russian 1978 signed to press 12 Jul 78 pp 3-9, 255

[Foreword and table of contents from book by Ye. M. Sokolovskaya and L. S. Guzey, Izdatel'stvo Moskovskogo Universiteta, 1940 copies, 255 pages]

[Text] Foreword

The materials currently used in industry operate at the limit of their potential. Austenitic heat resistant steels cannot be used at temperatures of more than 700°C, and the maximum temperature for the use of nickel-based alloys does not exceed 1000°C. Such parameters no longer satisfy the needs of present-day technology. Refractory metals (tungsten, molybdenum, niobium, etc.) and alloys based on them, while displaying high melting points, have a low scaling resistance and require protective coatings capable of withstanding the effect of aggressive media at high temperatures. Refractory nonmetallic materials such as carbides, nitrides, etc., as well as ceramic materials, while displaying a high oxidation resistance, have low heat resistance, impact strength, and tensile strength.

These shortcomings can be eliminated by developing systems that include materials with mutually complementing properties /1/.

In the last 10-15 years interest in exploring new ways of developing high-strength structural materials with a specified range of mechanical and physical properties has markedly increased. Currently, as is known, a steel with a maximum ultimate strength of 420 kg/mm^2 has been developed. However, the practical development of the technology of high-strength homogeneous monolithic materials does not seem feasible in view of their low plasticity and low ductile fracture strength. Attempts to develop high-strength homogeneous materials with satisfactory plasticity by such traditional hardening methods as alloying, heat treatment, various combinations and metalworking and heat treatment, etc., have not produced the desired results.

This is because, as V. S. Ivanova /2/ points out, the hardening produced by alloying or by thermoplastic treatment is associated with crystal lattice distortions of the alloy base, i.e., with an increase in the energy margin of the material. The ultimate limit of the energy margin of the crystal lattice due to metalworking or heat treatment is, in accordance with V. S. Ivanova's structural-energy theory, determined by the amount H of the metal's enthalpy at the melting point:

$$H = \int_{T_u}^{T_s} C_p dT,$$

where T_u is the specified temperature, T_s is the melting point, and C_p is the specific heat. The ultimate dislocation density ρm correspondingly computed as a function of H, at which the crystal lattice can still be conserved is limited for metals by a maximum of $\sim 10^{14}$ cm^{-2}. Thus, in the presence of the dislocation density of $\sim 10^{14}$ cm^{-2} the theoretical rupture strength is practically attained, but then the degree of distortion of the crystal lattice becomes such that the lattice comes close to an amorphous state. And indeed, thermoplastic treatment can induce in metals only a dislocation density of the order of 10^{12} cm^{-2}, which results in materials with a specific dislocation structure and an ultimate strength of 300-350 kg/mm^2. However, a steel hardened to such a level displays major shortcomings when used as a structural material, since exposure to rigorous loading conditions (low temperatures, dynamic or cyclic loads) causes a substantial loss of strength in the presence of a defect or crack, so that high-strength materials may then rupture under lower stresses than medium-strength materials /2/.

Thus, it is now increasingly obvious that any further advances in the technology of high-strength state of alloys, as reached by traditional methods, collide against the insurmountable barrier of brittleness.

Another major shortcoming of homogeneous metallic materials is their high sensitivity to the scale factor under demanding conditions of service.

In recent years the development of a number of branches of the new technology has required materials displaying a combination of low density (up to 3 g/cm^3), high modulus of elasticity (15,000-20,000 kg/mm^2), and a low coefficient of linear expansion ($(2\text{-}5)\cdot 10^{-6}$ deg^{-1}). In conventional alloys such a combination of properties is unattainable, since light metals (aluminum, magnesium) with a density of 1.7-2.7 g/cm^3 have an elasticity modulus of 5,000-7,000 kg/mm^2 and an extremely high coefficient of linear expansion ($(20\text{-}25)\cdot 10^{-5}$ deg^{-1}). Refractory alloys (molybdenum and tungsten) display a comparatively low coefficient of linear expansion ($(4.5\text{-}6.9)\cdot 10^{-6}$ deg^{-1}) and high elasticity modulus (30,000-40,000 kg/mm^2), but their density is high, amounting to 10.2-19.2 g/cm^3 /3/.

According to A. A. Bochvar the principal ways of enhancing the strength of metals are: cold deformation (cold working); fusion with components entering into the solid solution based on the lattice of the base metal; obtaining a high-disperse mixture of phases by quenching to supersaturated solid solution with subsequent tempering or aging; treatment of alloy with components which, already during the process of crystallization, form a new, harder phase in the form of a network along the boundaries of grains of the principal phase or in the form of a (skeleton) framework in a dendritic structure.

Further hardening in each of the above cases (except casting alloys, which are not amenable to deformation) can be achieved by applying thermomechanical treatment, which induces a stable substructure.

The simultaneous effect of all the hardening factors mentioned above is accomplished at temperatures not exceeding (0.3-0.4) of the melting point T_m. In particular, this exactly is how steels with a strength reaching 400 kg/mm^2 have been obtained at present.

When the temperature is raised to (0.5-0.6) T_m the hardening effect of the formation of solid solutions markedly diminishes. Hardening due to disperse segregations persists until (0.6-0.7) T_m, and only an additional complication of the composition and structure of the segregating phases and the alloying of the matrix solid solution make it sometimes possible to raise the operating temperature of the alloys to (0.7-0.8) T_m.

The advances in complex alloying combined with optimal heat treatment make it possible, e.g., to raise the level of operating temperatures of nickel alloys to 1000-1050°C. An additional increase in temperatures (up to 1100°C for nickel alloys) is achieved by refinements in technology (e.g., by oriented crystallization).

At the same time, it is perfectly obvious that the potential for further increase in heat resistance through additional alloying is at present nearing its limit. What is more, the addition of a large number of alloying elements produces adverse consequences: the solidus point of the alloys decreases, accumulations of brittle phases resulting in a decrease in fracture strength take form, and, as a result of the deterioration in their plasticity characteristics, many heat-resistant alloys become unamenable to technological treatment. This results in a marked gap between the levels of heat resistance of casting alloys and deformable alloys.

The elimination of the gap between the requirements of modern technology of structural materials and the potential of classical alloys is achieved by developing and using composite materials /4/.

For example, according to an American forecast of the prospects for using composite materials as heat resistant materials /5/, the proportion of composite materials among materials used in aviation, rocket engineering, and engine building will increase considerably in the immediate future. A 1970 jet engine consisted ~15 percent of alloyed steels, ~25 percent of titanium alloys, and only 3-5 percent of aluminum alloys and composite materials. Superheat-resistant alloys (chiefly nickel-based) accounted for more than 50 percent of engine weight, and are used in nearly all the parts operating at temperatures exceeding 430°C. In 1985 superheat-resistant alloys will continue to account for about 50 percent of engine weight, but the materials used in parts operating at less than 350°C will change markedly. Composite materials will entirely supplant aluminum alloys and partially supplant titanium alloys. In parts operating at up to 260°C composite materials will account for 70-75 percent of the materials used.

It is extremely difficult to define the concept of "composite material," since this term refers to a broad group of combined materials differing in structure and in the principles for their development, and moreover differing as regards the problems that have to be resolved for the industrial utilization of these materials. Apparently, K. I. Portnoy's definition /3/ applies best here: "Composite materials represent an artificial bulk combination of two or more materials differing in form and properties and having distinct mutual interfaces, such that the advantages of each material are exploited."

Thus, composite materials (or at any rate certain of their categories such as fibrous or laminar materials) display to a first approximation the sum of properties of their components, i.e., assure a combination of properties in a single material that is not possible in a single substance.

As regards the mechanism of their hardening CM can be divided into two groups. Underlying the hardening of the first group is the principle of the reinforcement of the metal matrix by high-strength loadbearing elements. This principle has been implemented earlier in nonmetal structural materials such as ferroconcrete, glass-reinforced plastics, etc. The level of the strength (and heat resistance) of the materials in this group depends mainly on the properties of the reinforcing elements themselves (continuous or discrete fibers in fibrous composite materials or flat elements in laminar materials), and the role of the matrix reduces chiefly to a redistribution of stresses between the reinforcing element.

In CM of the second group, which includes dispersion-hardened alloys, the leading role in hardening belongs to structural factors. The matrix in these alloys is the principal loadbearing element, while the role of the hardening phase reduces chiefly to facilitating the formation of the dislocation substructure during the production of the alloys, especially during their deformation and heat treatment, as well as to stabilizing that substructure under operating conditions /6/.

The principal problems to be solved in order to develop materials in each group are distinguished in accordance with the above classification.

The CM in the second group--dispersion-hardened alloys--do not fundamentally differ in their hardening mechanism from the classical aging alloys, the main difference being that, while in aging alloys the phase ratios are determined by the physicochemical processes of decomposition of supersaturated solid solutions, in dispersion-hardened alloys the phase ratios are artificially specified in the production process /4/. The principal difficulty is of a technological nature and consists in the need to assure a uniform distribution of the fine (optimal size 0.01-0.05 μm) hardening particles (thermodynamically highly stable refractory oxides, carbides, nitrides, etc.) in the metal matrix, with a mean interparticle distance of 0.1-0.5 μm.

The CM in the first group are extremely varied and may be divided into laminar (LCM) and fibrous (FCM) composite materials, with the latter, in their turn, being divided into those hardened by metal fibers and those hardened by nonmetal fibers. The general and principal problem for all these CM is the pattern of physicochemical interaction in the solid solution between the component parts of the composite (along with a large number of other problems specific to each kind of CM). This interaction should, on the one hand, take place to assure the bonding, so that the composite would perform as a single whole. On the other hand, this interaction should not develop too far, since this might result in the disappearance of the CM as such and the ultimate formation of an ordinary alloy or, in the early stages of the interaction, the softening of the hardening component.

The principal obstacle to the development of heat-resistant CM is the strong interaction between the matrix and fiber at high temperatures.

The ideal high-temperature CM should consist of components existing in a total equilibrium with each other within a maximally broad range of temperatures. However, the ideal case is hardly achievable, since both fibers and the matrices selected must also meet other requirements, such as a high unit strength, oxidation resistance, amenability to technological processing, etc. Hence, for a proper selection of the components of a CM designed to obtain some particular properties, a careful study of the chemical compatibility of the materials of the fiber and matrix is needed. For a better understanding of "chemical compatibility," two terms have been introduced: "thermodynamic compatibility" and "kinetic compatibility" /7/.

Thermodynamic compatibility is the state of thermodynamic equilibrium between matrix and fiber. It is possible only in the case of the so-called "natural" FCM, e.g., in eutectics with oriented crystallization when one of the components acts as the plastic matrix and the other as the hardening phase. Such CM are exemplified by the systems Co (matrix)-TaC (hardening phase) or Ni_3Nb (matrix)-Ni_3Al (hardening phase). In all other cases interaction is inevitable. Even if the change in free energy, as computed for standard state, is positive at interaction, at the initial time instant, when the concentration and hence also the activity of the i-component of matrix in the fiber or conversely is zero, the motive power of the reaction is infinite so that

$$\Delta\tilde{G}_i = RT \ln a_i; \quad a_i = - \text{ and } \Delta\tilde{G}_i = -00$$

Hence in most cases of artificial combining of various components this can be a question only of kinetic compatibility--the state of metastable equilibrium, which is affected by such factors as diffusion rate, rate of solid-phase chemical reactions, etc.

Any question concerning thermodynamic compatibility is answered by the corresponding diagram of phase equilibria. Knowledge of the diagram of state is particularly needed when developing CM for operation at high temperatures, since the increase in temperature is accompanied by an acceleration of the process of attainment of equilibrium and thermodynamic compatibility then becomes increasingly more important. For thermodynamically unstable systems diagrams of state also are extremely important, if only because they show the sequence of the reactions that will occur in the system and thus make it possible to take the necessary measures to eliminate their effect.

Unfortunately, so far the diagrams of state of such complex multicomponent systems as the industrial alloys most promising in the capacity of matrices have not yet been investigated. Calculations of the free energy of reactions between matrix and fiber components are possible only in rare cases, and even then they are only of an approximate nature. There exists only a small number of studies dealing with research into diffusion in three-component systems, and studies of more complex systems are virtually absent. Thus, all the problems of interaction in CM at present can be solved only experimentally, through the investigation of the zones of interaction--their composition, structure, growth kinetics as a whole, and individual structural components--as a function of matrix and fiber composition, temperature, time, and other factors.

The present monograph is devoted to an examination of the physical-chemical interaction of the components of composite materials.

The interest in composite materials is very considerable. This accounts for the large number of recent publications, including several monographs /1,3,4,8-15/, dealing with all the major problems that must be resolved in the development of particular composite materials. That literature devotes principal attention to the hardening mechanisms and the methods of producing the materials. On the other hand, the problem of the compatibility of various components has been relatively uninvestigated, although the solution of the question of controlled interaction is of fundamental importance. Without that solution research into new improved and more technological methods of obtaining these material would be pointless.

In this book attention is drawn to the physical chemistry of composite materials /16/.

The authors are indebted to Candidates of Sciences A. A. Dityat'yev, S. F. Dunayev, and Ye. M. Slyusarenko for assistance in preparing the manuscript.

Contents

Bibliography

1. "Kompozitsionnyye Materialy Voloknistogo Stroyeniya" [Composite Materials of Fibrous Structure]. Ed. I. I. Frantsevich and D. M. Karpinos, Kiev, 1970.

2. Ivanova, V. S. "Strength and Plasticity (Heat Resistance and Brittleness) of Composite Materials." METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA, 1975, Vol 9, p 73.

3. "Kompozitsionnyye Metallicheskiye Materialy" [Composite Metal Materials]. Ed. A. A. Tumanov and K. I. Portnoy, Moscow, ONTI, 1972.

4. Portnoy, K. I. and Babich, B. N. "Dispersno-Uprochennyye Materialy [Dispersion-Hardened Materials]. Moscow, Metallurgiya, 1974.

5. Janke, L. P. "The Importance of Processing Technology in the Future Development of Superalloys and the Gas Turbine." J. METALS, 1973, 25, 15.

6. Tumanov, A. T. and Portnoy, K. I. "New Ways of Increasing the Heat Resistance of Nickel Alloys," DAN, 1971, Vol 197, No 1, p 75.

7. Bates, H. E., Wald, F. and Weinstein, M. A. "A Contribution to the Question on Compatibility Between Metals and Certain High-Modulus Fibers." In: 10th National Symposium SAMPE, San Diego, 1966.

8. "Perspektivnyye Kompozitsionnyye Materialy" [Promising Composite Materials]. An Anthology. Moscow, ONTI, 1968.

9. Ivanova, V. S., Kop'yev, I. M., Botvina, L. R., and Shermergor, T. D. "Uprochneniye Metallov Voloknami" [Hardening of Metals by Fibers]. Moscow, Nauka, 1974.

10. Ivanova, V. S., Kop'yev, I. M., Yelkin, F. M., Busalov, Yu. Ye., Belyayev, V. I. and Kasperovich, V. B. "Aluminiyevyye i Magniyevyye splavy, Armirovannyye Volokname" [Aluminum and Magnesium Alloys Reinforced by Fibers]. Moscow, Nauka, 1974.

11. "Sovremennyye Kompositsionnyye Materialy" [Modern Composite Materials]. Ed. L. Broutman and R. Krock, [Russian translation]. Moscow, Mir, 1970.

12. Hollister, G. S. and Thomas, K. "Materialy Uprochnennyye Voloknami" [Fiber-Hardened Materials] [Russian translation]. Moscow, Metallurgiya, 1969.

13. Broutman, L. J. and Krock, R. H. Composite Materials. N. Y.-L., 1974.

14. Somov, A. I. and Tikhonovskiy, M. A. "Evteticheskiye Kompozitsii" [Eutectic Compositions]. Moscow, Metallurgiya, 1975.

15. Sokolovskaya, Ye. M. "Certain Problems of the Physical-Chemistry and Technology of Composite Materials." In book: "Problemy Khimii i Khimicheskoy Tekhnologii" [Problems of Chemistry and Chemical Technology]. Moscow, Nauka, 1977, p 18.

16. Proceedings of the 1978 International Conference on Composite Materials, ed. B. Notton, R. Cignoralli, K. Streets, and L. Phillips. April 16-20, 1978, Toronto, Canada. The Metal. Soc. AIME, N. Y., 1978

1386
CSO: 1870

LIST OF SOVIET ARTICLES DEALING WITH COMPOSITE MATERIALS

Moscow GOSUDARSTVENNYY KOMITET SOVETA MINISTROV SSSR PO NAUKE I TEKHNIKE. AKADEMIYA NAUK SSSR. SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY in Russian Vol 4 No 7, 1979 pp 3-5

[Following is a listing of the Soviet entries from SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY (SIGNAL INFORMATION. COMPOSITE MATERIALS), a bibliographic publication of VINITI. This listing is from Vol 4, No 7, 1979]

[Excerpts]

1. "Thermal Processes During the Casting of Bimetal of the Steel-Bronze System," Skvortsov, A. A., Vershinin, P. I., Golubev, A. M., Krasil'shikov, V. Ya. and Bakrin, Yu. N. IZV. VUZOV. CHERN. METALLURGIYA, No 12, 1978, 109-113.

2. "Indexes of Technological Effectiveness of the Fusion Welding of Bimetal Compounds," Fil'dzhyan, R. P. PROTSESSY, TEKHNOL. I KONTROL'V KRIOGEN. MASHINOSTR, Balashikha, 1978, 117-124.

3. "A Method for Investigating Temperature-Induced Stresses in Composite Models," Ushakov, B. N., Frolov, I. P. and Pen'kova, T. N. ZAVODSK. LABOR., 44, 1978, No 12, 1517-1520.

4. "Problems of the Mechanics of Composite Materials," Malmeyster, A. K., Tamuzh, V. P. and Teters, G. A. SOVREM. PROBL. TEOR. I PRIKL. MEKH. TR. 4-GO VSES. S'YEZDA PO TEOR. I PRIKL. MEKH., KIEV, 1976, Kiev. 1978, 359-372.

5. "Investigation of the Electronic Properties of Composite Materials," Dekhtyar, I. Ya., Madatova, E. G., Sakharova, S. G., Fedchenko, R. G. and Bukhalenko, V. V. METALLOFIZIKA [Kiev], No 74, 1978, 12-17.

6. "Investigation of Thermophysical Properties of Composite Materials in Research Into Highly Effective Matrix Heat Exchangers," Pritula, V. V., and Alekseyev, V. P. State Scientific Research Institute, Moscow, 1978, 14 pp, ill., 5 references (MS deposited at VINITI No. 3926-78, 26 Dec 78).

7. "Effect of the Chemical Composition of Bimetal on the Magnitude of Residual Stresses." Shabalin, V. N., Fridman, L. N., Radchenko, V. G. and Tov, G. M. IZV AN SSR. METALLY, No 1, 1979, 196-199.

8. "Rheological Characteristics of Impact-Resistant Polystyrene Compositions," UZB. KHIMIYA SH., UZB. KHIM. ZH., No 6, 1978, 64-66.

9. "Investigation of the Combined Effect of Temperature, Humidity and Filler-Fiber Orientation on the Strength of Carbon-Plastic Adhesives." Kudryavtsev, A. V., Ul'yanenko, A. P., and Umanskiy, E. S. PROBL. PROCHNOSTI, No 10, 1978, 68-70.

1386
CSO: 1842

LIST OF SOVIET ARTICLES DEALING WITH COMPOSITE MATERIALS

Moscow VINITI, GOSUDARSTVENNYY KOMITET SOVETA MINISTRON SSSR PO NAUKE I TEKHNIKE. AKADEMIYA NAUK SSSR. SIGNAL'NAYA INFORMATSIYA, KOMPOSITSIONNYYE MATERIALY in Russian Vol 4 No 8, 1979 pp 3-4

[Following is a listing of the Soviet entries from SIGNAL'NAYA INFORMATSIYA. KOMPOSITSIONNYYE MATERIALY (SIGNAL INFORMATION. COMPOSITE MATERIALS), a bibliographic publication of VINITI. This listing is from Vol 4 No 8, 1979]

[Excerpts]

1. Use of thermal destruction of ultrathin polymer films to study their interaction with the surface of a solid substrate. Pozdnyakov, O. F., Amelin, A. V., Mal'chevskiy, V. A., Podol'skiy, A. F., Regel', V. R., Redkov, B. P., Shalimov, V. V., "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978," Leningrad, 1978 pp 134-145.

2. Methods and some results of the study of the kinetics of high-temperature decomposition of composite materials. Shashkov, A. G., Polyakov, I. P., Tyukayev, V. I., Yadrevskaya, N. L. "Teplo- i massoperenos i perenosn. svoystva veshchestv," Minsk, 1978 pp 3-26.

3. Recrystallization graphite. Shipkov, N. N., Kostikov, V. I., Neproshin, Ye. I., Demin, A. V., Moscow, Metallurgiya Press, 1979 183 pages, illustrated.

4. Role of the inhomogeneous stress state in estimating the strength of models of adhesive bonds. Turusov, R. A., Vuba, K. T. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978 pp 75-84.

5. Some problems of the strength of adhesive bonds. Vaynshteyn, Ye. F. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978 pp 85-88.

6. A packet for the production of multilayer sheets. Nesmachnyy, A. N., Belokon', Yu. I., Ustimenko, V. A., Bykov, A. A., Khoroshilov, N. M., Krylovskiy, A. P., Golovanenko, S. A., Chervyakov, V. V., Buynevich, S. S., USSR Author's Certificates No 608634, filed 12/07/76; No 2388019, published 24/05/78.

7. Specifics of the rupture of carbon-carbon materials with two-dimensional filler. Trofimov, V. V., Kapralov, V. K., Sidorov, V. I., Ol'khovich, N. N. "Fiz. prochnosti kompozitsion materialov. Materialy Vses. seminara, Leningrad, 1977, 1978," Leningrad, 1978 pp 89-95.

8. Acoustical studies of the plastic properties of models of composites obtained by layer-by-layer bombardment of NaF single crystals. Kardashev, B. K., Nikaonorov, S. P., Smirnov, B. I., Khaydarov, K., Shalpykov, A. "Fiz. prochnosti kompozitsion materialov. Materialy Vses. seminara, Leningrad, 1977, 1978," Leningrad, 1978 pp 175-185.

9. Statistical mechanics of composite materials. Volkov, S. D., Stavrov, V. P. Minsk, Belorus. University Press, 1978 206 pages.

10. Redistribution of stresses in a composite material upon failure of fibers. Part 2r/Ul. Dynamics of the process of delamination of a broken fiber. Ovchinskiy, A. S., Sakharova, Ye. N., Kop'yev, I. M., Institute of Metallurgy, Moscow 1979, 26 pages, illustrated, 6 references (manuscript deposited at VINITI, No 287-89, deposited 23 Jan 1979).

11. Method of manufacture of a combined billet. Krylov, B. S., Karelin, F. R. USSR Author's Certificates No 612777, filed 29/12/76; No 2437681, published 19/06/78.

12. Influence of the nature of metal on thermal decomposition of fluoroolefins. Arsh, M. M., Madyakin, F. P., Lantsberg, L. B. "Fiz. aerodispersn. sistem (Kiev)," 1978, No 18 pp 59-62.

13. Selective transfer upon friction of metal-glass materials. Podgorkova, V. "Fiz.-khim. mekh. protsessa treniya," Ivanovo, 1978 pp 34-39.

14. Study of the wear-resistance of friction couples in sliding high-current contacts. Parkhomenko, A. S. "Mekh. i fiz. kontakt. vzaimodeystviya," Kalinin, 1978 pp 89-92.

6508
CSO: 1842

LIST OF SOVIET ARTICLES DEALING WITH COMPOSITE MATERIALS

Moscow GOSUDARSTVENNYY KOMITET SOVETA MINISTROV SSSR PO NAUKE I TEKHNIKE. AKADEMIYA NAUK SSSR. SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY, Vol 4 No 9, 1979 pp 1-6

[Following is a listing of Soviet entries from SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY (SIGNAL INFORMATION. COMPOSITE MATERIALS), a bibliographic publication of VINITI. This listing is from Vol 4 No 9, 1979]

[Excerpts]

1. Models of aluminum-metallic fibers and some of their properties. Khokhlov, G. G., Kardshev, B. K., Kostygov, A. S., Peller, V. V. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978, 202-206.

2. Microstructure of aluminum matrix in a model of a longitudinally-reinforced composition obtained by crystallization of the matrix material from the melt. Vorob'yev, M. A., Peller, V. V. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978, 207.

3. Temperature dependence of the viscosity of cement junction between glass-epoxy resin. Frantsuzova, L. P. "Prob. prochnosti," 1978, No 12, 95-98.

4. Diffusion welding of refractory alloys with high strength steels. Grishin, I. S., Samorodov, D. V., Prokhorov, A. A., Bordakov, P. A. "Vopr. tekhnol. pri-va letatel'n. apparatov" (Kuybyshev), 1978, No 1, 105-110.

5. On the problem of obtaining vacuum-tight fusion of aluminum with glass. Naruslishvili, V. A., Sarukhanishvili, A. V., Kovshikov, Ye. K. "Sakartvelos SSR Metsniyerebata Akademiis Moambe, Soobshch. AN GruzSSR," 1978, 92,No 1, 109-112. (Russian; resume Georgian, English).

6. Friction welding of titanium and niobium. Buts, B. D., Kvasha, A. N., Kedrin, I. D. "Avtomat. svarka," 1978, No 8, 17-19.

7. Calculation of dislocation of noncorrespondence in the adhesion theory of two crystals. Gubanov, A. I. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara; Leningrad, 1977, 1978." Leningrad, 1978, 96-98.

8. Mechanical destruction of metal-polymer junctions. Yegorenkov, N. I. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978, 53-65.

9. Scale factor in adhesion strength of a polymer-fiber system. Gorbatkina, Yu. A. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978, 66-74.

10. Relationship between strength and adhesion properties of polymer composites and the interaction of the components on the phase boundary. Tolstaya, S. N., Kozlov, G. V. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978, 42-52.

11. P. Welding method by melting dissimilar metals. Mishin, N. I., Kolpashnikov, A. I., Trutnev, V. V., Dunayev, A. A., Yevseyev, V. A. (Mosk. aviats. tekhnol. in-t). USSR patent (V23K9/02), No 631279 appl. 18.05.77, No 2486796, published 17/11/78.

12. Destruction patterns of some aluminum alloys and copper. Bakhtibayev, A. N., Betekhtin, V. I., Bobonazarov, Kh., Kadyrbekov, A., Regel', V. R. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978, 153-165.

13. Study of the nonuniformity of distribution of local deformations in microvolumes of structurally-inhomogeneous materials with iron as a base. Golovin, S. A. "Vzaimodeystviye defectov kristallich. reshetki i svoystva met." Tula, 1978, 69-79.

14. K. Physics of composite materials strength. Materialy Vses. seminara, Leningrad, 1-3 June, 1977; 6-7 April 1978. Editor Regel', V. R. et al. Leningrad, 1978, 218 pages, illustrations. 1 ruble, 50 kopecks.

15. Life of sheet elements reinforced by spacers made of composition materials. Beletskiy, V. M., Krivov, G. A., Gnatyuk, A. D., Rudakov, L. V., Yatsenko, M. I. "Probl. prochnosti," 1978, No 12, 53-55.

16. High strength wire with higher plastic properties according to TU [Technical specification] 14-4-4444-73 for reinforcing reinforced concrete ties. Gorelik, G. L., Rossikhin, V. A., Uvarova, L. N. "Tr. VNII zavod. tekhnol. sborn. zhelezobeton. konstruktskiy i izdeliy," 1978, No 23, 76-84.

17. Composition materials with nickel base. Portnoy, K. I., Babich, B. N., Svetlov, I. L., Moscow, Metallurgiya, 1979, 264 pages, illustrations, 3 rubles, 20 kopecks.

18. Study of the eutectic composition of zirconium-carbide of zirconium. Fadin, Yu. A., Sidorova, T. A., Guts, Z. A., Baskin, B. L., Kaloshnikov, Ye. V., Regel', V. R., Leksovskiy, A. M. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977, 1978." Leningrad, 1978, 186-195.

19. Hall effect in disordered materials using the ZrC-C system as an example. Gaysanyuk, A. V., Kugel', K. I., Petrov, V. A. "Fiz. tverd. tela," 1979, 21, No 1, 87-91.

2291
CSO: 1842

LIST OF SOVIET ARTICLES DEALING WITH COMPOSITE MATERIALS

Moscow GOSUDARSTVENNYY KOMITET SOVETA MINISTROV SSSR PO NAUKE I TEKHNIKE. AKADEMIYA NAUK SSSR. SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY, Vol 4 No 10, 1979

[Following is a listing of the Soviet entries from SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY (SIGNAL INFORMATION. COMPOSITE MATERIALS), a bibliographic publication of VINITI. This listing is from Vol 4 No 10, 1979]

[Excerpts]

1. Investigating the interphase interaction in composite materials based on magnesium reinforced with boron and steel fibers. Karpinos, D. M., Kadyrov, V. Kh., Gordyenko, A. I., Dzeganovskiy, V. P. "Poroshk. metallurgiya," 1978, No 12, 39-42 (English summary).

2. The effect of metal coatings on the wettability of carbon fibers by metal melts. Shoshorov, M. Kh., Savvateyeva, S. M. "Adgeziya rasplavov i payka materialov (Kiev)," 1979 No 3, 71-75.

3. The wettability of carbon-graphite pan-fibers by metal melts based on aluminum. Varenkov, A. N., Kostykov, V. I., Mozzhukin, Ye. I., Shimanyuk, V. T., Zakharov, Yu. N. "Adgeziya rasplavov i payka materialov (Kiev)," 1978 No 3, 62-65.

4. The thermodynamic method of calculating the effect of alloying additives on the interphase interaction in composite materials. Tuchinskiy, L. I., "Fiz. i khimia obrab. materialov," 1979, No 1, 121-126.

5. The structural stability of aluminum-boron and aluminum-silicon carbide composite materials at elevated temperatures. Maksimovich, G. G., Filipovskiy, A. V., Lyutyy, Ye. M. "Fiz. khim. mekh. materialov," 1979, 15 No 1, 49-52.

6. Bimetallic steel-aluminum wire for overhead communications lines. Vinogradov, G. A., Kalutskiy, G. Ya., Lysaya, A. I., Doroshenko, N. V., Britvich, V. A. "Poroshk. metallurgiya," 1979, No 1, 23-28.

7. The intermolecular surface forces of adsorption interaction in a plane densely packed hexagonal model. Leytane, M. Ya. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 156-158.

8. The characteristics of soldering glass with metal contacts. Tikhomirova, O. O., Lopatin, V. A. "Adgeziya rasplavov i payka materialov (Kiev)," 1978, No 3, 102-103.

9. P. A Method of a producing a platinite workpiece. Mondrik, V. F., Lapitskiy, V. V., Epov, G. A., Kreymerman, G. I., Tskhorebov, V. I., Bolgov, I. S., Bitsayev, V. P., Mutovin, V. D. USSR author's certificate, (V 21 S 23/30), No 618155, application dated 12 Feb 77, No 2453636, published 20 Jun 78.

10. The contribution of the thermofluctuating dimensional effect to the strength of a fiber composite. Petrov, V. A., Savitskiy, A. V., Gorshkova, I. A. "Probl. prochnosti," 1979, No 1, 59-61.

11. The stability and optimum design of multilayer cylindrical composite shells strengthened by a polyregular system of crossed ribs. Pochtman, Yu. M., Tugay, O. V. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 96-105.

12. The dynamics of stress redistribution in the ruptured fiber of a composite material. Sakharova, Ye. N., Ovchinskiy, A. S. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polymerov'"), 1979, No 1, 57-64.

13. Summation of damage during transient cyclic loading of glass fiber-reinforced plastics. Parfeyev, V. M., Oldyrev, P. P., Tamuzh, V. P. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 65-72.

14. The effect of characteristics of materials reinforced three-dimensionally by short fibers. Khoroshun, L. P., Maslov, B. P. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 3-9.

15. The dependence of the dynamic sheer modulus and the speed of sound of composites on the degree of filling. Startsev, O. V., Perepechko, I. I. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 165-167.

16. A conference on problems of predicting the long-term resistance of polymer materials. Yanson, Yu. O., "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 174-175.

17. The moment effects in the plane problem for a cross-reinforced laminated composite. Partsevskiy, V. V. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 48-50.

18. The propagation of elastic shear waves in a composite fibrous medium. Golovchan, V. T., Girya, M. G. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 146-149.

19. Evaluating the zone of the disturbed stress state during tension of composites. 2. Analysis of stress distribution. Polyakov, V. A., Zhigun, I. G. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 136-145.

20. Surfaces of equally long strength of organic textolite in a plane stressed state. Maksimov, R. D., Sokolov, Ye. A., Plume, E. Z. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, no page numbers given.

21. Problems of the mechanics of composite materials. Tamuzh, V. P., Teteras, G. A. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 34-35.

22. Investigating the strength of spheroplastics. Telegin, V. A., Filyanov, Ye. M., Petrilenkova, Ye. B. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. poly-polimerov'"), 1979, No 1, 73-78.

23. The phenomenological approach to determining the durability of composites. Vladimirov, V. I., Trushin, Yu. V. "Fiz. prochnosti kompozitsion. materialov. Materialy Vses. seminara, Leningrad, 1977-1978," Leningrad, 1978, 99-106.

24. The dielectric properties of composites with regular structure. Levin, V. L., Nevolin, V. K., Shermergor, T. D. "Zh. tekhn. fiz.," 1979, 49, 519-526.

25. Analysis of the integral characteristics of the deformability of some two- and three-dimensionally reinforced composites. Zilauts, A. F., Krager, A. F. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 21-26.

26. Optimization of the structure of three-dimensionally reinforced composites in stability problems. Kreger, A. F., Teters, G. A. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 79-85.

27. The stability of elastic laminated reinforced shells. Andreyev, A. N., Nemirovskiy, Yu. V. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, 86-95.

28. Investigating the thermostability of the Mechanical Properties of Carbon Fibers. Mostovoy, G. Ye., Kobets, L. P., Frolov, V. I. "Mekh. kompositn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, No 1, 27-33.

29. The deformative properties of the structure of organic fibers based on parapolyamides. Kyrzemniyeks, A. Kh. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, 10-14.

30. The effect of accelerated climatic testing on the strength and deformability of glass fiber-reinforced textolite under low-cyclic tension. Sarkisyan, N. Ye., Kravchenok, V. L., Petrov, V. S. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polimerov'"), 1979, 163-165.

31. Variation of some physico-mechanical characteristics of glass fiber-reinforced plastics during accelerated aging. Matison, Ya. Ya., Shtraus, V. D. "Mekh. kompozitn. materialov" ("Byvsh. 'Mekh. polymerov'"), 1979, 150-155.

32. Determining the fatigue strength of composite materials in a plane stressed state. Stepanenko, N. D., Vyakin, V. N. "Probl. prochnosti," 1979, No 1, 55-59.

33. P. A method of welding refractory chrome-nickel steels and alloys. Birman, U. I., Zheleznyak, M. A., Shvets, M. Ya., Zamaltdinov, R. I., Ryzhov, N. F., Stankovskiy, P. V. USSR authors' certificate, (V 23 K 9/16), No 604642, application 25 Mar 75, No 2116711, published 27 Apr 78.

34. P. Composite Material. Komarov, M. A., Ignatovskaya, G. S., Kudimov, V. A. USSR Author's certificate, (S 22 S 38/00, S 22 S 25/00), No 522262, application 11 Apr 75, No 2125917, published 17 Jul 78.

CSO: 1842

LIST OF SOVIET ARTICLES DEALING WITH COMPOSITE MATERIALS

Moscow GOSUDARSTVENNYY KOMITET SOVETA MINISTROV SSSR PO NAUKE I TEKHNIKE, AKADEMIYA NAUK SSSR. SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY Vol 4 No 11, 1979

[Following is a listing of the Soviet entries from SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY (SIGNAL INFORMATION. COMPOSITE MATERIALS), a bibliographic publication of VINITI. This listing is from Vol 4 No 11, 1979]

1. Thermodynamic evaluation of the influence of alloying on the interphase interaction in composite materials, which have been reinforced by fibers made of high-melting compounds. Tuchinskiy, L. I. "Poroshk. metallurgiya," 1978, No 12, 81-85.

2. Effect of metallization of carbon fibers in a carbide-forming melt on their compatibility with copper and aluminum. Kashin, O. A., Ovcharenko, V. Ye., Borisov, M. D., Dudarev, Ye. F., Tregubov, V. F., Migalev, V. V., Krotov, Yu. G. "Adhesion of melts and soldering of materials (Kiyev)," 1978, No 3, 75078.

3. Physical chemistry of composite materials. Sokolovskaya, Ye. M., Guzey, L. S., M., MGU, 1978, 265 pp, illus., 3 r. 10 kop.

4. Properties of a bimetal in relation to manufacturing conditions. Zasukha, P. F., Nikoforov, V. K., Yershov, A. A., Lemishchenko, G. K., Nikolayev, A. V. "Theory and practice of the production of strip steel (Moscow)," 1978, No 3, 49-51.

5. Certain principles and features of the formation of diffusion coatings by selective precipitation of low-melting metals. Chayevskiy, M. I., Artem'yev, V. P., Il'yenko, V. A. "Adhesion of melts and soldering of materials (Kiyev)," 1978, No 3, 88-91.

6. Certain problems in studying the kinetics of destruction of adhesion compounds in composites. Regel', V. R., Leksovskiy, A. M., Abdumanonov, A., Orlov, L. G. "Physics of the strength of composite materials. Materials of the All-Union Seminar, Leningrad, 1977, 1978" L., 1978, 107-123.

7. DEP. On the application of correlational approximation formula for calculating the physical characteristics of composite materials. Mendenl'son, V. M., Ural'sk. politekhn. in-t, Sverdlovsk. 1979, bibliography, 6 titles. (Manuscript sent to VINITI No 970-79. Deposited since 20 March 1979).

8. Structure and properties of composite materials. Portnoy, K. I., Salibekov, S. Ye., Svetlov, I. L., Chubarov, V. M., M., Mashinostroyeniye, 1979, 255 pp, illus. 1 r, 20 kop.

9. Composite materials on a titanium base. London, G. D. Metallurgy and technology of titanium. Trudy of the Third International conference on titanium, Moscow. 1976, Vol 3" M., 1978, 517-533. Discussion p 583.

10. Growing reinforced monocrystals of indium antimonide by the Stepanov method. Nosov, Yu. G., Antonov, P. I., Nikanorov, S. P., Regel', V. R. "Physical Strengths of composite materials. Materials of the All-Union Seminar. Leningrad, 1977, 1978" L., 1978, 196-201.

11. Study of production conditions and properties of titanium-magnesium composite materials. Fratsevich, I. N., Karpinos, D. M., Tuchinskiy, L. I., Sapozhnikova, A. B. "Metallurgy and technology of titanium. Trudy of the Third International Conference on Titanium, Moscow, 1976, Vol 3" M., 1978, 551-556. Discussion, 583.

12. Instruments and equipment. Bekon, S. Ye. "Composite Materials. Vol 3" M, 1978, 366-414.

13. Study of the structure of fibrous composite materials with a matrix on a titanium base. Shorshorov, M. Kh., Bakarinova, V. I., Antipov, V. I. "Metallurgy and technology of titanium. Trudy of the Third International Conference on Titanium, Moscow, 1976. Vol 3" M., 1978, 535-541. Discussion, 583.

14. Study of the friction of laminated plastics and F4-K20 and F4-K15M5 fluoroplastic compositions without lubrication. Novikov, I. I., Zakharenko, V. P. "Chemical and Petroleum Machine Construction," 1979, No 3, 36-37.

15. Chemical enterprises. Mallinson, D. Kh. "Composite Materials, Vol 3" M., 1978, 308-365.

16. Model composite (laminate) material on a titanium base. Petrova, L. A., Grankova, L. P., Belyayev, B. I., Korzhenevskiy, A. P., "Metallurgy and technology of titanium. Trudy of the Third International Conference on Titanium, Moscow, 1976, Vol 3" M., 1978, 543-549, Discussion, p 583.

THE EXPERIMENTAL PLANT OF THE INSTITUTE OF ELECTRIC WELDING imeni YE. O. PATON

Kiev AVTOMATICHESKAYA SVARKA in Russian No 5, 1979 pp 6-9

[Article by G. B. ASOYANTS, Plant Director]

[Text] The Experimental Plant of the Institute of Electric Welding was organized in 1959. This was the first plant in the system of the USSR Academy of Sciences. At the present time, the practical experience gained by 20 years of existence of the scientific and technical complex, with its production basis, has been widely acknowledged, is extensively studied and used elsewhere.

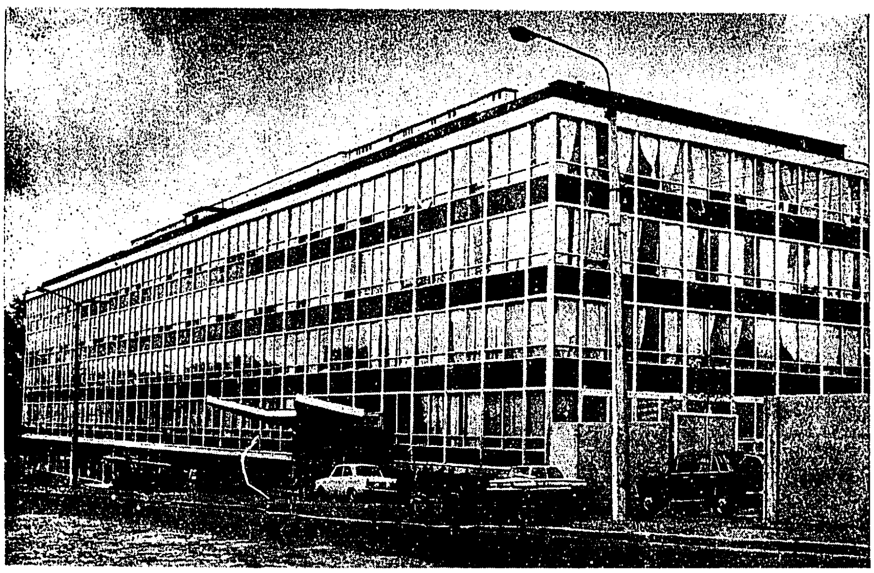
The practice of continuing scientific research until its results are introduced into production, which is followed at the Institute of Electric Welding, and in recent years at other scientific research institutes of the UkrSSR Academy of Sciences, the high scientific and economic effectiveness of this practice, have been approved by the Central Committee of the Party and have been highly evaluated by the General Secretary of the CC CPSU, Chairman of the Presidium of the Supreme Soviet of the USSR, L. I. Brezhnev, at a meeting with the Presidents of the Academies of Sciences of the socialist countries.

The role of the experimental plant as one component of the scientific and technical complex is great, responsible and honorable. From year to year, the capacity of the plant increases, productivity and culture of labor increase, and the experience of previous years is accumulated and creatively used. Today, the Experimental Welding Equipment Plant consists of broad, well-lit shops, with a total area of some 29,000 m^2 modern machine tools, progressive equipment, qualified workers and employees.

Let us mention a few of the entries from the guest book of the experimental plant.

The General Director of ZIL, P. D. Borodin, Chief Welder of the plant, M. M. Fishkis: "We are very impressed with this excellently organized experimental plant, the like of which we have seen nowhere."

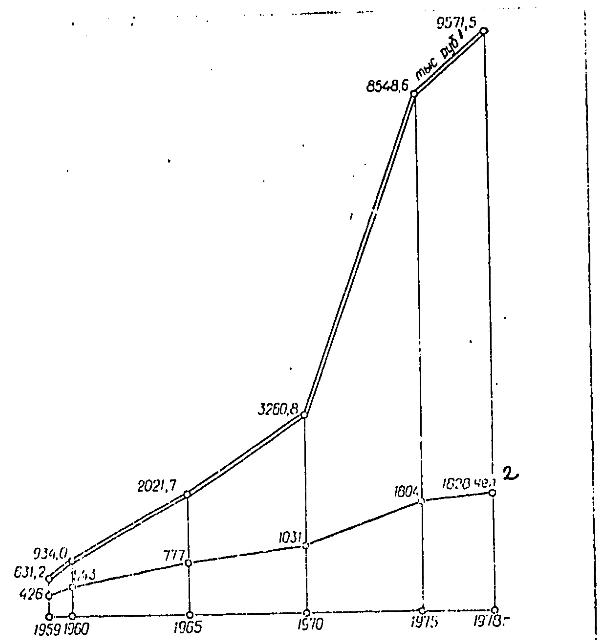
Vice President of the McDermott Company E. D. Dressel (USA): "This is a very well organized plant, with high productivity. The level of manufacture of the equipment is excellent. The pipe welding installation is very well made, and the demonstration of this machine was impressive. I congratulate all of the workers of the Institute of Electric Welding for their outstanding organization."



Overall view of the experimental plant.

Minister of the Electrical Engineering Industry of the USSR, A. K. Antonov: "I thank you for the opportunity to become familiar with your remarkable plant and its work. I hope that you will continue to be a strong support for science and technology in Soviet welding in the future."

The welding equipment produced at the plant encompasses practically all types and methods of welding developed by Soviet scientists. At the present time, it is hard to find a city in the USSR which does not use equipment with the brand name of the Experimental Plant of the Institute of Electric Welding. From the day it was created, its shops have produced over 32,000 units of welding hardware of 4,000 types, a significant fraction of which has been put in use at 1,500 enterprises, organizations and constructions projects in 510 industrial centers of the nation. The machines and apparatus produced by the workers at the plant have been generally recognized in all branches of domestic industry. These devices are equal to the best foreign models in their design and quality of manufacture. For example, five types of products have been awarded the State Mark of Quality. In 1978, the number of products with the Mark of Quality reached 10.7% of the total quantity of apparatus manufactured at the plant.

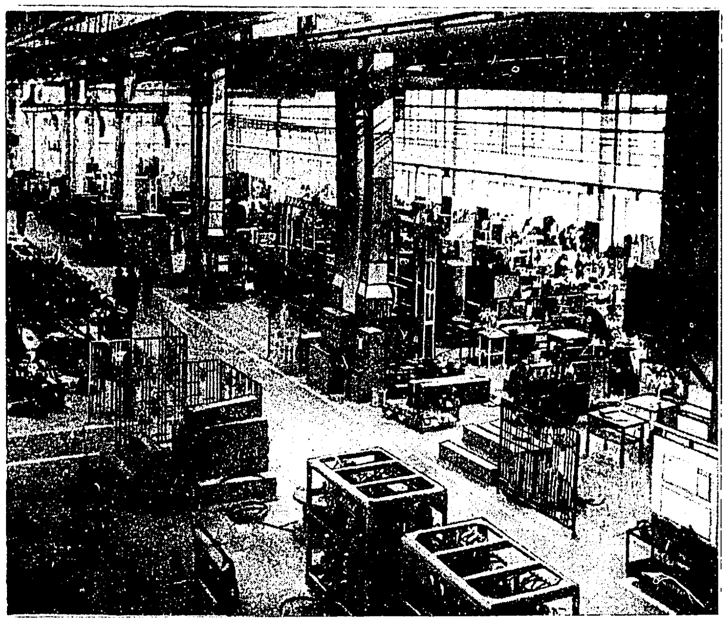


Increase in output of welding equipment and number of personnel at the experimental plant over the past 20 years.
Key: 1, thousands of rubles; 2, persons.

The products of the plant have also gained a reputation, even in the most highly developed capitalist countries. The experimental plant of the Institute of Electric Welding has been awarded prizes at many international exhibitions, and its equipment can be found in 37 nations of the world, including the USA, Japan and West Germany.

The "Vulkan" Installation, manufactured at the plant in 1969, performed a unique experiment involving welding and cutting of metals in space for the first time in the world on board the "Soyuz-6" spacecraft. In 1975, the plant manufactured the first machine for spot welding of mainline oil and gas pipelines 1420 mm in diameter under the conditions of the far north.

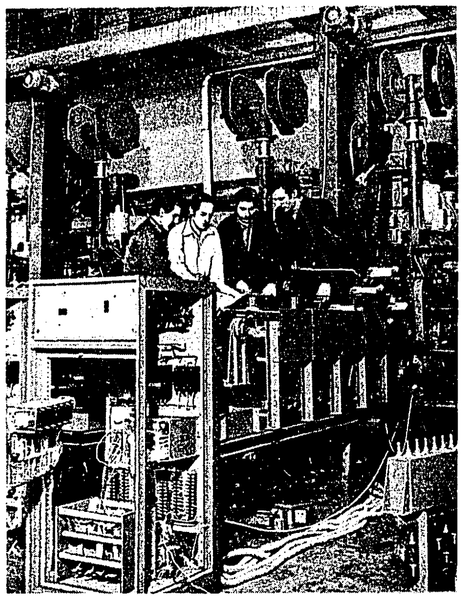
Using this unique 26 ton machine, builders of pipelines can weld 60 joints per shift, thus liberating 120 welders. In 1978, in close cooperation with the scientists of the Institute of Electric Welding, a complex of modern equipment was manufactured for the production of multilayer pipe at the Khartsyzskiy Pipe Pipe Plant, and a series of installations was created for welding and surfacing on production lines of the Kama, Gor'kiy, and Volga Motor Vehicle Plants and other plants.



An assembly shop in the experimental plant

The experimental plant has created excellent conditions for the productivity of labor of its workers and for increases in their qualifications. The plant has an airfield on the banks of the Dnepr, one of the best pioneer camps in the Ukraine at Koncha-Zaspa, and the comfortable steamship "Patonovets" for the use of the workers and their families. One evidence of the concern of the plant for preservation of health and working ability of its workers is the model residence hall for 500, with its modern dining hall, clinic, motion picture and concert hall, as well as the system of vacations for workers in the summertime. The plant includes one of the most active physical culture teams in the UkrSSR Academy of Sciences, and independent artistic activities are well developed.

Due to the need for continued growth of the production and technical capacity for scientific research at the Institute of Electric Welding imeni Ye. O. Paton, the decision has been made to construct a second section of the experimental plant. This will double the output of welding equipment at the plant.



The team headed by V. K. Sirik assembles and adjusts an installation for surfacing of motor vehicle spring supports for KamAZ.

The interior of the plant dining hall.

The workers of the experimental plant are applying full efforts to perform the new, important tasks which stand before them, and their selfless labor, and high level of social activity will raise the authority of the Paton trade name still higher.

6508
CSO: 1842

EXPERIMENTAL DESIGN-TECHNOLOGICAL BUREAU OF THE INSTITUTE OF ELECTRIC WELDING imeni YE. O. PATON, UkrSSR ACADEMY OF SCIENCES

Kiev AVTOMATICHESKAYA SVARKA in Russian No 5, 1979 pp 3-6

[Article by A. I. CHVERTKO, Doctor of Technical Sciences]

[Text] On 16 May 1959, on the initiative of academician B. Ye. Paton, an experimental-design bureau (OKB) was organized in the Institute of Electric Welding imeni Ye. O. Paton, In October of 1978, a resolution of the Presidium of the UkrSSR Academy of Sciences reorganized the OKB as the Experimental Design and Technology Bureau (OKTB).

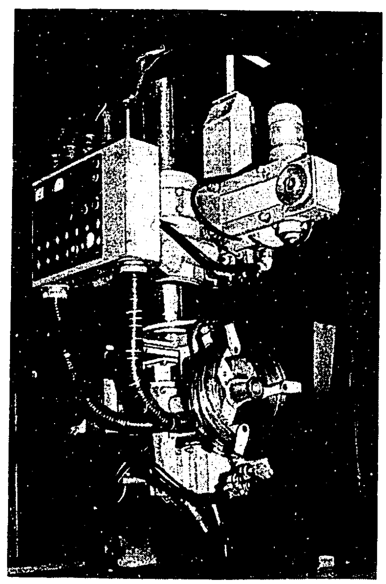


Figure 1. The A-1411 automatic corner-seam welder.

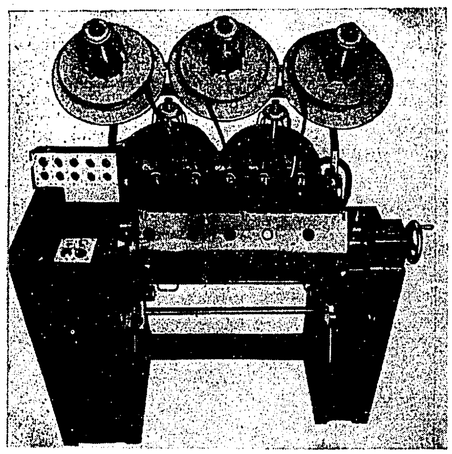


Figure 2. The UD-139 surfacing machine.

The OKTB of the Institute develops, studies and introduces new technological processes, hardware and equipment for practically all known methods of mechanized welding and surfacing of metals, as well as special electrometallurgy. The equipment developed is manufactured at the experimental plant of the Institute, as well as plants of the Electrical Engineering Industry Ministry and other enterprises.

Primary attention of the OKTB is given to problems of complete mechanization of welding, creation of highly productive installations and continuous assembly-welding lines.

At the present time, the workers of the OKTB number more than 1800 persons. They include doctors and candidates in technical sciences, highly qualified design engineers, technologists, technicians and other specialists, combined into departments, sectors or teams, in accordance with the main area of scientific activity. The OKTB has an affiliate in Kakhovka at the Electric Welding Equipment Plant.

One peculiarity of the activity of the OKTB is the creative cooperation between designers and testing personnel, on the one hand, and scientists and specialists of the Institute of Electric Welding, branch institutes and other leading enterprises. For example, the OKTB maintains commmunications with the All-Union Scientific Research Institute for Electric Welding Equipment (Leningrad) and its affiliates at Tbilisi and Vil'nyus, with the welded cable office of "Ukrkabel'" Plant, with VISP, VPTIyakhmash, VNIImetmash, etc. The OKTB has concluded direct agreements and negotiations for creative cooperation with more than 180 enterprises in the country.

Cooperation begins in the stage of composition of a technical assignment for development of equipment and continues through to the introduction of the equipment by the efforts of combined teams consisting of fellows from the institute, designers, technologists and technicians from the OKTB and the enterprises.

This work style allows the OKTB to rapidly perform developments which are necessary and important for the national economy. For example, the model A-1197P and A-547U semiautomatic welding machines, developed by the OKTB, are quite popular in industry. The PTG-508 semiautomatic machine, developed in cooperation with Kakhovka's Electric Welding Equipment Plant, is well recommended. The "Intermigmag" semiautomatic machine was designed in cooperation with the CEMA member countries. A range of heavy automatic welding machines, the A-1400 series, is in successful use for arc welding. An example is the A-1411 automatic welder (Figure 1), which features a high level of automation of all primary and secondary operations. Equipment for electric-slag welding and arc welding with forced shaping of thickwall structures is in wide use in heavy and electric power machine building, in construction and various other branches of industry. The OKTB has given primary attention to the planning of highly productive systems of equipment for welding and surfacing of massive parts and sections of motor vehicles and tractors, now in successful operation at KamAZ and the Lozovo Foundry and Mechanical Plant. The U703 installation for multiple-arc single-sided welding of ship decks, in use at the Baltic Shipyard in Leningrad, is quite interesting. Since 1972-1973, the Il'nitsk Experimental Plant of the Machine Tool Industry Ministry of the USSR and the Chelyabinsk Experimental Plant "Rostekhosnastka" have organized series production of a range of universal surfacing machines, the U-651...U-654, made of standardized units; over 340 machines have been built. An experimental run of UD-139 specialized machines (Figure 2) has been produced for the surfacing of crankshaft necks. The Khartsyzsk Pipe Plant is successfully using systems of equipment on a production line for series production of straight-seam welded gas and oil pipeline pipe 1220-1620 mm in diameter and is beginning to use unique equipment in an experimental section for production of multilayer pipe 1420 mm in diameter, including an installation (Figure 3) for multiple-head welding of the outer circular seams of multilayer pipe. Work is being conducted on the creation of equipment for welding of multilayer pipe at the Vyksunskiy Metallurgical Plant. Equipment has been planned and manufactured for production of spirally welded pipe 529 mm in diameter using high speed induction welding, etc.

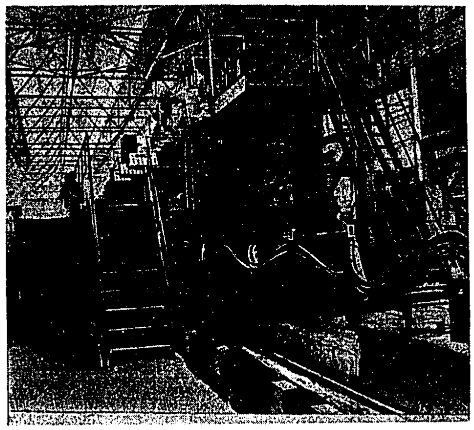


Figure 3. Installation for multiple-head welding of the outer circular seams of multilayer pipe.

Simultaneous welding with several heads, the use of multiple-position, including rotary, welding machines and installations, simultaneous servicing of several welding units by one worker (multiple-post work) — all of these are important paths for increasing the productivity of welding labor. In this direction, the OKTB has also been very active in development. For example, at the Khartsyzskiy Pipe Plant, a U-747 installation for arc welding of assembly seams by six heads simultaneously is in use, while the Altay Tractor Plant is successfully using a type U-95 automatic rotary welding and assembly machine for arc welding of tractor wheels.

Various branches of the national economy are successfully using microplasma welding. The apparatus created for microplasma welding saves the economy over 20 million rubles each year.

Of the equipment for spot welding, we might mention the highly productive systems of multiple-spot welding of the crankcases of powerful transport diesel engines, a series of machines for welding of products of aluminum alloys, series produced universal machines for welding of circular products and fittings, the "Sever-1" system, and a number of machines for seam welding of the ends of steel strips.

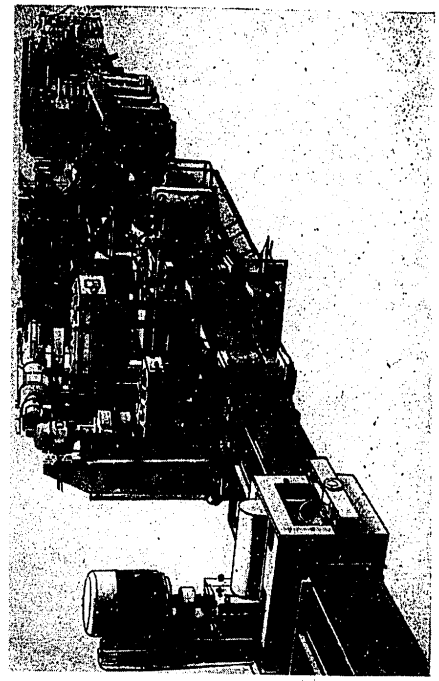


Figure 4. Automatic continuous line for production of heating radiators.

The OKTB, in cooperation with the Institute, has developed equipment for electron-beam and condensor welding, welding-soldering and other new methods of joining materials. Also in cooperation with branch organizations and enterprises, a number of completely mechanized, semiautomatic and automatic continuous-flow assembly and welding lines have been developed, which are operating successfully in various branches of the economy. In particular, in cooperation with VNIImetmash, an automatic line has been created (Figure 4) continuously producing heating radiators.

Great efforts have been expended by the designers of the OKTB toward the creation of equipment for specialized electrometallurgy. Furnaces for electric-slag, electron-beam and plasma-arc remelting are in successful operation in industry (Figure 5).

The OKTB, together with the Institute, has created and introduced new power supplies for welding under flux, in protective gases, pulsed-arc welding of aluminum alloys and special steels, for multiple-position arc welding at a nominal total current of 5000 A. A number of smoothly adjustable power supplies with nominal currents of 750, 1600 and 3000 A have been developed for ac plasma-arc remelting installations at the OKTB, as well as a special attachment allowing operation at a constant current of up to 1500 A.

Figure 5. U-599 furnace for plasma-arc remelting.

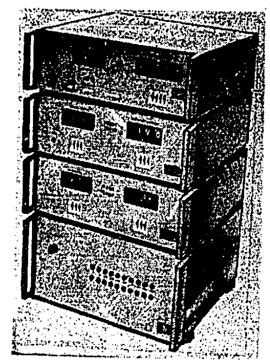


Figure 6. Programmed control systems for control of parameters of electron-beam welding.

Specialized thyristor drives, arc voltage regulators, programming devices, time regulators for seam and spot welding, various tracking systems, including systems with automatic joint search, have been created and put in use. This has significantly increased the level of automation of welding equipment and the reliability of control systems. In pipe production, industrial television installations have been introduced, allowing the conditions of labor to be made easier, while increasing the quality of welding. Systems for automatic direction of an electron beam to a joint and systems for programmed control of the welding parameters (Figure 6) have been developed, allowing automation of the welding of important parts with variable thickness of the material being joined. The Gor'kiy

Motor Vehicle Plant has manufactured the first industrial robot in the USSR for contact spot and arc welding, designed in cooperation with the Institute of Electric Welding and the OKTB.

Over 50 types of welding equipment designed by the Institute are being series produced at 12 plants in the country. The experimental plant of the Institute itself manufactures small batches of about 20 types of equipment for various methods of welding.

In the two decades of its existence, the OKTB of the Institute of Electric Welding imeni Ye. O. Paton has accumulated valuable experience in the creation of equipment for mechanized welding and its introduction into the national economy. Using this experience, the OKTB is significantly expanding work on standardization and aggregation of equipment in order to produce welded hardware and equipment made of standard modules. This will allow a further increase in the level of mechanization and automation of welding across the nation.

6508
CSO: 1842

- END -

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000100100032-4