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1 June 1981

USSR Report

MATERIALS SCIENCE AND METALLURGY

(FOUO 2/81)

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COMPOSITE MATERIALS

FAILURE OF COMPOSITE MATERIALS

Riga RAZRUSHENIYE KOMPOZITNYKH MATERIALOV: TRUDY PERVOGO SOVETSKO-AMERIKANSKOGO SIMPOZIUMA in Russian 1979 pp 5-8

[Foreword and table of contents from book "Failure of Composite Materials: Proceedings of the First Soviet-American Symposium", edited by Dzh. K. Si, Lehigh University, and V. P Tamuzh, Latvian SSR Academy of Sciences, "Zinatne"]

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III. Types of Failure

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FOREWORD

Although work on the development and investigation of modern composite materials has been in full swing only during the last 15-20 years, composite structural materials are already today in extensive use in industry. The potential of composites is considerably greater than that of traditional materials not only due to excellent specific stress-strain properties but also due to fundamental new qualities which are not inherent in the individual components of a composite material.

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Problems of composite materials are frequently discussed today in the literature and at conferences. Conferences dealing with some one current problem in the target area of science are the most productive. Such problems in the mechanics of composite materials include the strength and crack resistance of a material; its importance is increased by the complexity of the investigated material, its inhomogeneity and anisotropy. The first Soviet-American symposium on failure of composite materials, the proceedings of which are contained in this volume, was held in Riga in September 1978, with the aim of thorough and comprehensive discussion of these extremely important problems of mechanics of composite materials.

One can note two basic areas in study of the failure of composite materials. The first is connected with investigation of the macrobehavior of a composite material without considering damage, while the other involves detailed study of microdamage and types of failures occurring in a material under load. These two approaches are developing almost independently of one another. The behavior of a composite material cannot be correctly understood without consideration of damage occurring in a material at the micro- and macroscopic levels. In order to ensure reliability in utilizing many modern materials in structures, it is essential to consider physical damage in describing the behavior of a material. Necessary for such a consideration is basic knowledge of the various types of failure and an understanding of how failures (microcracks, for example) affect the behavior of a composite material.

Investigation of microfailures also includes study of microstress concentrators, their origin in the process of manufacture of a material and the causal factor of the manufacturing process. It is important to investigate the kinetics of the process of failure at all stages, from micro- to macrofailure -- by utilizing direct recording and diagnostic methods, predicting failure of regions of contact between components in composite materials, and development of methods of computation and processes of manufacture of materials with optimal failure resistance characteristics.

The necessity of solving the problems enumerated above defines the tasks facing researchers -- study of such items as the correlation of micro- and macrofailure in composite materials, consideration of the statistical characteristics of a composite material, prediction of failure, application of linear mechanics of failure to composite materials, consideration of the actual conditions of failure of composite materials, in particular the influence of moisture, stress concentrators, complex stressed state, discussion of the manufacturing aspects of the problem of failure resistance of composite materials, and the behavior of natural composite materials.

The purpose of the Soviet-American symposium on failure of composite materials was discussion of one problem of composite materials, namely the problem of failure, as thoroughly and comprehensively as possible. Therefore personal invitations were sent to a small number of U.S. and Soviet scientists, as well as certain researchers in England, France, and the FRG, who are working actively in this field and are studying the problem in its various aspects: elucidation of the basic causes of failure of composite materials, elaboration of applied problems of failure of composite materials applicable to individual branches of industry, development of improved composite material manufacturing processes, and investigation of biocomposite materials.

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Another aim of the first Soviet-American symposium on failure of composite materials was establishment and strengthening of personal contacts and exchange of information between Soviet and U.S. scientists for the purpose of development of fruitful scientific collaboration and cooperation in reducing world tensions.

A. K. Malmeyster, chairman of the
Organizing Committee of the Symposium,
president of the Latvian SSR Academy of
Sciences

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FERROUS METALLURGY

FERROUS METALLURGICAL INDUSTRY TARGETS FOR 1981

Moscow METALLURG in Russian No 1, Jan 81 pp 2-3

[Article: "Tasks of Ferrous Metallurgy in 1981"]

[Text] The Soviet people are greeting in an atmosphere of enormous political and labor enthusiasm the 26th CPSU Congress, which will summarize accomplishment of the targets of the 10th Five-Year Plan and will define the strategy and tactics of our country's socioeconomic development at this next stage of building communism.

The entire Soviet people are presently discussing the CPSU Central Committee draft document for the 26th CPSU Congress, entitled "Principal Directions of Economic and Social Development of the USSR in 1981-1985 and the Period Up To 1990," the main content of which is securement of further growth in the prosperity of Soviet citizens on a foundation of stable, forward development of the national economy, acceleration of scientific and technological progress and changeover by the economy to an intensive path of development, more efficient utilization of this country's production potential, all-out savings in all categories of resources, and improvement in quality of performance.

For ferrous metallurgy the draft document specifies radical improvement in quality and expansion of the metal products mix, increase in the production of economical rolled stock, pipe and tube, extensive retooling of ferrous and nonferrous metallurgical enterprises, refurbishing of basic equipment, improvement of manufacturing processes, and strengthening of the raw materials base.

During the years of the preceding five-year plan much has been accomplished in all areas of building communism. There has been a substantial growth of scientific-technological and economic potential, our homeland's defense capability has become stronger, efficiency of production has improved, the material and cultural living standards of our people have been steadily rising, socialist democracy has become stronger, and a policy of seeking international détente is being persistently implemented.

Great success has been achieved in our country's economy. In 1980 national income reached 436 billion rubles, with 80 percent of this sum going directly for securing the people's prosperity. All branches of industry and agriculture, including ferrous metallurgy, experienced considerable further growth and development

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For many years now the Soviet Union has exceeded the industrially most developed capitalist countries -- the United States and Japan -- in volume of production of all categories of metal products. Production of rolled stock is stably exceeding 100 million tons. This industry's production potential has greatly increased: one of Europe's largest shops for cold-rolling carbon-steel sheet has come on-stream at the Novolipetskiy Metallurgical Plant, an oxygen-converter shop with MNLZ [expansion unknown] at the Cherepovets Metallurgical Plant, a 150 mill at the Beloretsk Metallurgical Combine for producing 5.5 mm diameter rod, pelletizing facilities at the Severnyy and Dneprovskiy Mining and Concentration combines, as well as a number of facilities for the production of ferroalloys, iron ore, coke, pipe and tube, general metal products, plus other products.

Movement on-stream of new, high-output metallurgical facilities meeting today's demands considerably boosts the level of technology and speeds technological advance in this industry.

Soviet metallurgists have done much to increase the production of metal products and to improve their quality.

Priority growth in the volume of production of economical metal products was accomplished in the 10th Five-Year Plan in order to achieve fuller satisfaction of the growing requirements of metals-consuming industries. There has been a substantial improvement in the strength characteristics of steel, due to alloying and heat treatment.

During the years of the 10th Five-Year Plan approximately 500 new grades of steel went into production, and more than 700 new hot-rolled, cold-bend and high-precision rolled sections; new, economical types of steel pipe, tube and general metal products commenced production, providing technical resource growth and metal savings; there was achieved a severalfold increase in the percentage share of products bearing the Seal of Quality in total output.

Implementation of the program advanced by the decisions of the November (1979) CPSU Central Committee Plenum and the June CPSU Central Committee decree (1980) makes it possible to achieve metal savings both in ferrous metallurgy proper, as a result of increasing usable yield at all stages of metallurgical production, and in the various sectors of the economy in the process of metal consumption. There is no doubt as to the effectiveness of the adopted policy of development of metallurgy in the direction of securing metal savings in the nation's economy. Specific capital outlay per ton of economized metal is approximately 40 percent less than that for increasing physical production volume.

Considerable work has been accomplished in this industry in the area of social services and benefits for ferrous metallurgical workers. A total of 2.7 billion rubles were allocated for these purposes. More than 11 million square meters of housing were completed for occupancy, as well as children's preschool accommodations for 63,000 children, 7,500 hospital beds, general outpatient clinics accommodating 16,500 patient visits, and schools accommodating 60,000 pupils.

Addressing the October (1980) CPSU Central Committee Plenum, Comrade L. I. Brezhnev presented a profound analysis of the state of the national economy at the

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threshold of the 11th Five-Year Plan and set forth important targets in the area of future economic and cultural development.

While noting the successes achieved in development of the economy in the 10th Five-Year Plan, the party and Soviet people also see unresolved questions, difficulties and deficiencies, as discussed by Comrade L. I. Brezhnev in his speech at the October (1980) Plenum. These are difficulties connected with supplying the population of certain areas of the country with foodstuffs and manufactured goods, lag in housing construction, deficiencies in capital construction, etc.

Our party sees as its goal and objective a steady rise in the prosperity of the people. Therefore the targets for the 11th Five-Year Plan will focus considerable attention on today's most important problems -- elaboration of large-scale specific programs to increase the production of foodstuffs and manufactured goods for the population, ensuring a rise in the living standards of Soviet citizens.

Dynamic, proportional development of the nation's economy and accomplishment of the task of raising the level of prosperity of the people depends to a significant degree on the performance of ferrous metallurgy which, carrying out state plans in the area of turning out metal products, creates conditions for shifting the entire economy over to intensive development.

Ferrous metallurgy plays a major role in sequential implementation of the program of extensive utilization of this country's industrial potential to boost agriculture. It is necessary to increase the service life and durability of equipment and individual agricultural equipment components, to increase the output of clad steel for plowshares, galvanized weldwire fencing for livestock raising, Fregat steel pipe, phosphate fertilizers and other products of this branch for the needs of agriculture.

The plan calls for further strengthening of the material and technological foundation of the transportation industry, and rail transport in particular. Toward this end facilities for heat-treatment strengthening of rails are being constructed in the ferrous metallurgical industry, output of low-alloy high-strength steel for railroad car construction is being increased, as is production of wheels and tires, clad wire for electrification of rail lines, track fasteners, clamps, fishplates, and bearing plates. Ferrous metallurgy is not only a metal supplier but also one of the largest users of the services of the Ministry of Railways. Today one out of every five cars traveling this country's rails is carrying either raw materials for ferrous metallurgy or the products of that industry. Therefore, alongside an increase in the production of railway steel, the industry has been assigned the task of reducing inefficient freight hauls and freight car downtime.

An important role is played by ferrous metallurgy in satisfying the metal requirements of the fuel and energy branches of industry. An extensive program has been assigned to this branch for supplying the needs of the oil and gas industry, a program involving upgrading existing and building new petroleum industry pipe finishing departments, and production is expanding on high-strength drill, casing and pump-compressor pipe with new types of connections and increased corrosion resistance.

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In order to expand the capabilities of conveying gas from new gas fields, metallurgical workers have been assigned the task of producing pipe for main gas pipelines operating at a pressure of 75 atmospheres, pipe 1420 mm in diameter, and multilayer pipe operating at a pressure of 100 atmospheres, suitable for Arctic service. Projects carried out by the people at the Central Scientific Research Institute of Ferrous Metallurgy, the All-Union Pipe Scientific Research Institute, the Azovstal', Novolipetskiy and Khartsyzsk plants have demonstrated the high degree of efficiency of manufacture of Soviet large-diameter pipe of frost-resistant low-alloy steels.

Priority growth in construction of nuclear power stations faces metallurgical workers with the task of boosting production of high-alloy electropolished pipe and pipe for high-pressure boilers.

In discussing the role of ferrous metallurgy in improving this country's fuel and energy balance, one must mention utilization of secondary energy resources. The CPSU Central Committee gave its approval to the experience of the Magnitogorsk Metallurgical Combine and a number of other Soviet enterprises in the area of bringing secondary energy resources into production, emphasizing that the most extensive dissemination of this know-how, adoption of energy-conserving technology, and fuller utilization of secondary energy resources is a task of national importance.

The new five-year plan will be an important stage in implementation of the program advanced at the June (1980) CPSU Central Committee Plenum, calling for economical consumption of metal in the nation's economy. In order to achieve this goal, the plans for 1981 and subsequent years assign ferrous metallurgy the task of increasing production of advanced and economical products. In the first year of the 11th Five-Year Plan production of rolled ferrous metals will total 109.2 million tons, and steel pipe -- 18.5 million tons. Industry will put 140 new rolled sections into production, there will be an 8 percent increase in output of cold-rolled sheet, and a 21 percent increase in production of rolled product of low-alloy steel. Accomplishment of the program to improve the quality of metal products requires the closest contact both with manufacturers of metallurgical equipment and construction people, as well as with metal consumers. This contact is essential at all stages -- from design and engineering to customer product utilization. In order to achieve fullest satisfaction of specific consumer requirements on metal products, the USSR Ministry of Ferrous Metallurgy proceeded to draw up comprehensive programs for 1981-1985 jointly with the machine-building ministries.

In order more fully to meet this country's metal requirements, much also remains to be done in development of ferrous metallurgy proper. This applies first and foremost to accelerated development of its ore base, reduction of iron and metal losses at all stages of metallurgical production, improvement and renovation of the industry's fixed assets by means of production retooling, and accelerated movement of new facilities on-line.

Further improvement in the quality of metal products and efficient utilization of metal in the nation's economy imposes large and responsible tasks on the science serving this industry. Scientific research institutes must complete to the stage of commercial adoption projects dealing with increasing the strength, purity and homogeneity of metal, plastic deformation of high-strength and difficult-to-deform

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steels, economical nitride-vanadium strengthening of rolled product and pipe, development of fundamentally new low-waste ferrous metals production technologies, and development of cokeless metal production processes, powder metallurgy in particular.

Production people, scientists and designers will be devoting particular attention to the rapid adoption of the processes and facilities of such unique near-completion complexes as the Oskol'skiy Electrometallurgical Combine, oxygen-converter shops at the Cherepovets Metallurgical Plant and the Plant imeni Dzerzhinskiy, the 3000 and 3600 plate mills at the Western Siberian Metallurgical Plant and the Plant imeni Il'ich, plus a number of others.

Implementation of a broad program of measures aimed at technological advance will promote a significant improvement in the technical-economic indices of this industry, and improved labor productivity in particular; mechanization of laborious jobs and automation of production will be accomplished on a considerably larger scale. Adoption of automation is presently acquiring exceptional importance. Plans call for beginning a transition from local systems of control of manufacturing processes to comprehensive automatic control systems for units, shops and enterprises based on mathematical simulation, with the extensive employment of electronic computers. Adoption of a substantial number of machines and mechanisms developed both at the organizations of the Ministry of Heavy and Transport Machine Building and within the USSR Ministry of Ferrous Metallurgy system is targeted with the aim of accomplishing tasks of mechanizing laborious jobs in main and auxiliary production operations.

A high degree of concentration of production requires increased attention to problems of ecology. Plans call for all existing enterprises to establish health protection buffer zones, to reduce the discharge of untreated effluents, and to install gas scrubbing equipment. Installation of closed-cycle water supply systems is specified for new industrial plants. Adoption of new equipment and processes will also help appreciably reduce the quantity of harmful pollutants entering the atmosphere.

Our party sees as its goal a steady rise in the people's living standards. Therefore USSR Ministry of Ferrous Metallurgy plans devote considerable attention to an increase in the manufacture of consumer goods, strengthening the material-technical base of worker supply, increased completion of housing in comparison with 1976-1980, construction of children's preschool facilities, preventive clinics and other cultural, social and domestic services facilities.

In conformity with the CPSU Central Committee and USSR Council of Ministers decree entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Improving Production Efficiency and Work Quality," it is planned to carry out in this branch measures pertaining to high-quality reorganization of planning and management activities and strengthening of the role of economic instruments and incentives to achieve excellent and labor performance results. In 1981 an experiment began at a large number of enterprises of this branch to reevaluate the performance of work forces, an experiment which will make it possible to improve resolution of the socioeconomic problems of enterprise growth and development. The main precondition for highly productive and stable performance by ferrous metallurgy in the new five-year plan, however, will be extensive adoption of scientific and technological advances, improvement of

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material-technical support, elimination of disproportions in the development of individual enterprises, and improvement in technological and production discipline.

It is necessary more fully to utilize all forms of socialist competition, to disseminate more broadly the experience of leading work forces, to enlist in this task the extensive group of activist efficiency and production innovators, party, Komsomol and trade union organizations.

Ferrous metallurgy is faced with tough tasks. Their accomplishment requires of metallurgical workers a sharp rise in the level of performance. The large scale of pre-congress socialist competition graphically attests to the fact that this country's metallurgical workers will make every effort to accomplish the tasks assigned to them by the party and government in 1981.

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STEELS

NEW BOOK DISCUSSES STEEL INGOT THERMAL PHYSICS

Kiev TEPLOFIZIKA STAL'NOGO SLITKA: SBORNIK NAUCHNYKH TRUDOV in Russian 1980 (signed to press 12 Feb 80) pp 2, 179-181

[Annotation and table of contents from book "Thermal Physics of a Steel Ingot: Collection of Scientific Papers", edited by Academician V. A. Yefimov, UkSSR Academy of Sciences Institute of Problems of Casting, 800 copies, 181 pages]

[Text] This volume contains materials which reflect the principal scientific advances in the area of study of the thermophysical processes of casting steel and solidification of steel ingots.

Articles examine the features of the influence of thermophysical conditions of crystallization on formation of the structure of steel ingots and development of physical and chemical inhomogeneities, the convective movement of liquid metal in a crystallizing ingot, on the processes of mass transfer and conditions of formation of liquation defects.

Materials are presented on elaboration and improvement of mathematical models for numerical investigation of the thermal processes of solidification of ingots and castings.

This volume is intended for scientists, engineers and technicians working with problems of optimization of manufacturing processes of producing steel ingots and castings and improving the quality of metal products.

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SUPERHARD MATERIALS

NEW BOOK DISCUSSES SUPERHARD COMPOSITE MATERIALS

Kiev KOMPOZITSIONNYYE SVERKHTVERDYYE MATERIALY in Russian 1979 (signed to press 26 Dec 79) pp 2, 159-160

[Annotation and table of contents from book "Superhard Composite Materials", edited by Doctor of Technical Sciences P. S. Kislyy, Ukrainian SSR Academy of Sciences Institute of Superhard Materials, 500 copies, 160 pages]

[Text] This volume contains articles dealing with investigation of the processes of interaction and bond forming at a phase boundary, on the technology of forming and sintering composite materials, on study of the properties of tools employing metal, ceramic, and polymer bonds, and on problems of designing tools and equipment for their manufacture.

The articles are based on research conducted in the division of superhard refractory materials of the Institute of Superhard Materials of the Academy of Sciences of the Ukrainian SSR.

This volume will be of use to scientists, engineers and technicians specializing in the area of materials science, as well as engineers at machine-building enterprises and enterprises of this country's tool industry.

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TITANIUM

METALLOGRAPHY OF TITANIUM ALLOYS

Moscow METALLOGRAFIYA TITANOVYKH SPLAVOV in Russian 1980 (signed to press 15 Jul 80) pp 4-6

[Annotation and table of contents from book "Metallography of Titanium Alloys", by Yelena Andreyevna Borisova, Georgiy Andreyevich Bochvar, Moris Yakovlevich Brun et al., Izdatel'stvo "Metallurgiya", 2700 copies, 464 pages]

[Text] This book examines modern metallographic methods of investigation (microscopy and electron microscopy, fractography, x-ray structural and micro x-ray spectral analyses, high-temperature metallography). The volume contains constitutional diagrams of the major binary and ternary titanium-based systems, as well as metastable diagrams illustrating the phase composition of binary and ternary titanium alloys following quenching from various temperatures. Considerable attention is devoted to the interrelationship of stress-strain and particularly service properties, phase state and parameters of microstructure of titanium alloys. The authors present typical macro- and microstructures of semimanufactures of commerical titanium alloys in various states, defects encountered in semimanufactures and finished parts, and the possible causes of their formation.

This volume is intended for physical metallurgists at scientific research institutes and factory laboratories working in the area of titanium alloys. It can also be of use to students enrolled at machine building and metallurgical higher educational institutions. 293 illustrations. 70 tables. Bibliography of 222 items.

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WELDING

FUTURE IMPROVEMENT, DEVELOPMENT OF WELDING IN USSR

Moscow SVAROCHNOYE PROIZVODSTVO in Russian No 3, Mar 81 pp 2-4

[Article by Academician B. Ye. Paton: "Tasks of Further Improvement and Development of Welding Production in the USSR"]

[Text] In the last two decades the purposeful and consistent development of welding production has been defined by comprehensive government programs, the execution of which, together with economic and social development plans and coordinated monitoring of execution, with the active participation of the lead institute of the IES [Electric Welding Institute] imeni Ye. O. Paton, ensured resolution of many problems in the area of scientific and technological advance both in welding production proper and in leading branches and sectors of the economy.

During the period in question targets in four comprehensive programs were formulated and, for the most part, successfully accomplished: the seven-year plan covering 1959-1965, and three five-year plans covering 1966 - 1970, 1971-1975, and 1976-1980.

As a result, welding science and technology have advanced far in their development. Today we possess a powerful, well-equipped welding production base, which accounts for approximately 50 percent of the total volume of production of welded structures, castings, forgings, and drop forgings. The percentage share of jobs performed with the aid of automatic welders, semiautomatic welders, spot welders and other machines in the total volume of welding production has increased almost fivefold (from 11 percent in 1958 to 53.1 percent in 1979).

Successes in the development and adoption of new welding equipment and techniques have made it possible to set up in this country production of structures which are much needed by our economy and have made fundamental changes in a number of industries. In particular, large-section methods were adopted in the construction of seagoing vessels, and the design and manufacture of large, massive items in the heavy, power, and chemical machine-building and machine-tool industry were organized on a new technological foundation. One can scarcely exaggerate the contribution made by welding in the construction of plants and installations in the ferrous and nonferrous metallurgical industry, petrochemical industry and nuclear power engineering.

In the process of carrying out the 1976-1980 program, however, certain bottlenecks were revealed, and efforts in the forthcoming 11th Five-Year Plan must be concentrated on overcoming these bottlenecks.

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For example, total production volume of welded structures in 1979 exceeded the 1975 figure by approximately 10 percent, but employment of advanced structural materials (rolled product of high-strength steels, aluminum and aluminum alloys, as well as bent structural shapes) is patently inadequate. In 1979 it amounted to only 5 percent of the total production volume of welded structures, as compared with 4 percent in 1975. Accelerated adoption of the above materials is continuing to be impeded not by limited capabilities of welding equipment but by a shortage of this equipment.

Certain advances have also been made in the area of facing, the volume of which (in terms of welded-on metal) in 1979 exceeded the 1975 figure by approximately 12 percent. The percentage share of facing is still too small, however, in the manufacture of new parts and assemblies.

Approximately 300,000 units of electric welding equipment were manufactured in 1979. However, the total number of automatic and semiautomatic welding machines produced by the principal manufacturer of electric welding equipment, Minelektrotekhprom [Ministry of Electrical Equipment Industry], is falling intolerably behind the target specified for this ministry for 1980. Increase in manufacture of replacement parts for welding equipment continues to be a serious unresolved problem. In 1979 the volume of manufacture of replacement parts did not exceed 2 percent of total equipment manufacture, as compared with the 7 percent targeted for 1980.

Production of welding materials for mechanized welding techniques is steadily growing. In 1979, for example, 21 percent more solid welding wire was produced than in 1975, and 7 percent more powder filler wire. Production of the latter, however, is still far below the 1980 target, while production of alloy wire 1.4 mm in diameter and smaller comprises only 30 percent of the total production volume of small-diameter filler wire.

The patently retarded growth in production of equipment and materials for mechanized welding techniques is unquestionably leading to a situation where the percentage share of jobs performed with the aid of automatic and semiautomatic equipment, etc, has failed to show a rising trend for several years now.

At the present time it is important to accomplish an extensive changeover to total mechanization and automation of all processes of fabrication of welded structures, which is possible only with the availability of centralized production and provision to the economy of comprehensive welding equipment (KSO), especially mechanical. A special program ratified in April 1975 was directed toward this, a program which was unsatisfactorily implemented in the 10th Five-Year Plan. In particular, Minelektrotekhprom failed to accomplish in 1976-1979 movement on-stream of planned facilities for the manufacture of KSO. The situation is even worse as regards the specified completion of facilities for the manufacture of mechanical welding equipment within the Minstankoprom [Ministry of Machine Tool and Tool Building Industry] system, where construction has not yet begun on a main plant with an output capacity of 50 million rubles per year.

Taking the above into consideration, USSR Gosplan, the USSR State Committee for Science and Technology, and the IES, with the participation of more than 100 ministries and agencies, drafted a new, fifth program for improvement and development of welding production for 1981-1985. It specifies solving problems connected

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with utilization of reserve potential for increasing labor productivity, economical expenditure of material and labor resources, elaboration and adoption of automated control systems in the fabrication of welded structures.

A prominent place in the new program is occupied, alongside measures to correct the stated deficiencies, by matters pertaining to increasing the durability of welded structures and the efficiency of utilization of rolled ferrous metals in their manufacture, etc, corresponding with resolution of problems affecting the nation as a whole and the ways to solve them specified by the CPSU Central Committee and USSR Council of Ministers decree entitled "On Improving Planning and Strengthening the Effect of the Economic Mechanism on Improving Production Efficiency and Work Quality."

The comparable production volume of welded structures in industry and construction is to be increased in 1985 for the USSR as a whole by 30 percent over the anticipated figure for 1980. The rate of production growth of these structures is to be greater than the growth rate of steel and rolled products output. This trend is to be continued in the future.

Considerable attention is devoted to specialization and concentration of welding production. The program specifies designing and building new specialized enterprises and shops in 12 ministries.

Also planned are measures called upon to intensify scientific and technological advance in the area of design and fabrication of welded structures. Plans call for reducing the materials and labor requirements in their manufacture, increased precision and efficiency, as well as operational reliability and durability.

In particular, plans call for comprehensive improvement in forms and shapes of structures and the structure of rolled stock utilized in them. Plans call for an increase in the percentage share of employment of improved, medium and high strength steels, expansion of the variety of bent, bent-welded and thin-walled sections, including bisteel, as well as precision hot-rolled sections.

Of considerable importance are measures to achieve substantial improvement in utilization of rolled ferrous metals in welded structures, as well as expanded utilization of advanced structural materials and manufacturing processes promoting improved metal protection against corrosion and increased durability of structural elements.

The program specifies improvement of existing and development of new guideline materials on designing and fabrication of welded structures for major types of machine-building products, as well as state and branch standards.

Implementation of the program-specified measures will make it possible to raise the technical level of design and manufacture of welded structures, to improve their quality and economy, which is fully in conformity with the tasks of the CPSU Central Committee decision entitled "On the Performance of Metallurgical, Machine-Building and Construction Ministries in the Area of Improving the Quality of Metal Products and Efficient Utilization of Metal on the Basis of Adoption of Low-Waste Processes in Light of the Demands of the November (1979) CPSU Central Committee Plenum."

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Weld-facing operations should experience further development, with maximum increase in the percentage share of production-type facing and jobs performed by automatic and semiautomatic machines.

An important component part of the program is continuation of a policy of boosting the scientific and technical level of design and fabrication of welded structures and total mechanization of their production. This will make it possible to produce more economical products with utilization of the most modern technical devices and to raise the overall level of production sophistication.

Ministries and agencies should prepare technical documentation and establish in production associations and at enterprises fully mechanized shops, departments, sections, production and assembly lines. A large volume of work is to be performed in the area of designing and installing at enterprises automated control systems based on employment of computer hardware.

Plans call for developing mechanical and welding equipment, as well as equipment for gas-flame processing of metals, equipped with means of mechanization and automation, including industrial robots.

Accomplishment of the above-enumerated work, in combination with measures specified in the previously adopted specific program pertaining to organization of centralized manufacture of KSO, will make it possible to achieve significant results in the area of total mechanization of manufacture of welded structures.

Plans specify that by 1985 the volume of welding performed on automatic, semi-automatic, spot-welding and other machines will increase to 70 percent of the total volume of welding operations in the USSR as a whole. To achieve this, manufacture of electric welding equipment must be increased by 40 percent and gas-flame equipment by 60 percent over plan-specified figures.

Plans call for increasing specialized facilities for the manufacture of electric welding equipment, including expansion of the Elektrik Plant imeni N. M. Shvernik, the Kakhovka Electric Welding Equipment Plant, and completion of construction of the Pskovsk Heavy Electric Welding Equipment Plant. Plans call for building the first Minelektrotekhprom plant unit for the manufacture of plasma equipment, as well as renovation and expansion of facilities of the Voronezh Avtogenmash Production Association, the Barnaul Machinery and Equipment Plant, and the Kirovakan Avtogenmash Plant.

Production of welding materials is targeted taking into account priority development of highly-mechanized methods of production of welded structures. With a slight decrease in electrode production volume, plans specify an increase in the manufacture of filler wire, and in particular a 60 percent increase in production of alloy filler wire up to 2 mm in diameter, and a 50 percent increase in powder wire over 1980. Increased production of fluxes, solders, and shielding gases is correspondingly targeted.

An increase in alloy wire production capacity is targeted for the Western Siberian Metallurgical Plant, the Zaporozh'ye Metal Products Plant, as well as the Revda Metal Products-Metallurgical Plant; powder filler wire -- at the Western Siberian

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Metallurgical Plant, the Dnepropetrovsk Metal Products Plant, the Magnitogorsk Metal Products and Metallurgical Plant, at the Beloretsk Metallurgical Combine, and in the USSR Minmontazhspetsstroy [Ministry of Installation and Special Construction Work] system.

The program formulates targets pertaining to manufacture in the coming five-year period of new process equipment for furnishing enterprises for the manufacture of welding materials currently in use as well as new materials.

The program devotes considerable attention to the social aspects of welding production. Specifications have been drawn up on protective clothing for welders and the materials from which such clothing is made. Industrial testing is presently being conducted on more than 10 models of protective suits for welders working in different climatic conditions. One model -- a suit for manual and semiautomatic welding personnel -- has been in series production for several years now at the Shatura and Krivoy Rog Garment factories.

In recent years a new group of welder's lenses has been developed, possessing improved protective properties for a broad range of welding processes. They provide the welder's eyes good protection against the ultraviolet and infrared rays of the welding arc and broaden the welder's visual capabilities. A new GOST is presently being drawn up for light filters, and preparations for their series manufacture are in progress at the Chernyatinskiy Glass Plant.

In the near future series manufacture will be set up for new types of face shields, helmets, convenient and safe electrode holders, and work is in progress to improve ventilation equipment for welding shops, as well as development of built-in welding equipment exhaust fans. The appropriate organizations are revising branch standards on free issue of clothing to welders and are drafting nationwide safety regulations for welding and gas-flame operations.

Many problems remain to be solved, however, in the area of labor protection and safety. The new program includes, in particular, targets pertaining to organization of series production of five new models of protective clothing, gloves made of heat-resistant phenylone fiber, lenses with improved color contrast, hand shields for arc welders, and a number of devices for monitoring welder working conditions (ventilation, temperature, humidity and other parameters of the work environment).

The newly-begun five-year period should be a time of purposeful assimilation of amassed knowledge and utilization of theoretical and applied research and development, which will ensure a further boost in the quality of welding production. Plan targets for the development of new, advanced manufacturing processes have been specified on the basis of adoption of scientific advances. These advances include welding under flux into a slotted separator, which will be extensively employed in power engineering and heavy machine building; higher-productivity techniques of welding nonferrous metals and alloys, to be utilized in electrical equipment, heavy and power machine building, as well as the automotive industry; continuous laser welding and gas laser cutting of metals, ensuring excellence of weld and high-quality cutting; electron-beam welding, which is being more and more extensively adopted in power engineering and chemical machine building and in the construction of nuclear reactors; high-output welding with preheating of cast-iron body components;

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electroslag hardfacing of cold-rolling rolls and facing hydroturbine blades with powder filler wire.

The new program specifies measures pertaining to development of scientific research and experimental facilities of establishments working in the field of welding, which will require additional working space. Therefore plans call for construction of tens of thousands of square meters of floor space in engineering-laboratory buildings and experimental facilities.

In light of the specified program of plan targets, a number of measures are to be carried out in order to achieve further improvement in the training and advanced training of engineers, technicians, and welders. In particular, it is necessary to set up in Leningrad and Kiev technical schools for training and advanced training of welders and welding equipment setup personnel.

Development and extensive adoption into production of nondestructive testing methods is a very important direction in further improving the quality of welded structures. A leading role should be played by mechanization and automation of inspection processes, ensuring stable quality.

Certain success has been achieved in this area in recent years. The volume and level of scientific research have improved, and there has been a certain increase in series manufacture and variety of flaw detection equipment. X-ray and gamma-ray radiography methods and various techniques of checking the soundness of welded joints have found application in the fabrication of welded structures. Ultrasonic, magnetic, luminescence and color flaw detection have experienced considerable development. Betatron radiography is being utilized more and more extensively to inspect welds on thick-walled structures. Initial models of automatic ultrasonic equipment have been placed in service, and mobile magnetograph laboratories have been developed. Many of the developed flaw detection devices are equal in specifications and performance to the world's finest.

The scale and rate of employment of nondestructive inspection of welded joints, however, are lagging considerably behind the level of development of Soviet welding production, which is due chiefly to an inadequate volume of design and development of the latest equipment, slow commencement of series production of this equipment, and a lack of adequate production capacity to make up for the shortage of and satisfy steadily growing demand for equipment.

In order to correct this deficiency and to achieve further improvement in the efficiency of welding production, specific programs were adopted in 1979, for development and adoption in industry of modern methods and means of nondestructive inspection of the quality of welded joints.

These programs, which are an inseparable part of the overall policy of development of welding technology in this country, specify increasing capacity to manufacture the above-mentioned inspection devices, with the target of increasing production volume more than threefold by 1985 in comparison with 1980. The bulk of flaw detection equipment will be manufactured within the system of the Ministry of Instrument Making, Automation Equipment and Control Systems. Within this system a number of existing enterprises will be renovated and expanded, and a new,

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specialized plant will be constructed, which will become the nucleus of a future flaw detection equipment subbranch.

In coming years plans call for substantially improving supply to industry and construction of basic materials for flaw detection (X-ray film, magnetic-particle powders, pastes, etc).

A central position is occupied by the problems of modernizing existing and developing new means of nondestructive inspection of welds with the performance of appropriate scientific research, planning-design and experimental work prior to the stage of manufacture of commercial models or test batches, that is, before this equipment is fully ready for series manufacture. Plans call for developing in 1979-1984 several dozen units of modern equipment of general and specialized designation for ultrasonic, radiographic, magnetic, electromagnetic, and capillary flaw detection and seal testing.

Measures have been drawn up for development of scientific research, planning-design and engineering organizations engaged in the development and adoption of inspection and testing devices as well as strengthening of their experimental and test-production base.

The lag which has occurred in providing welding production with modern inspection methods and means is also due to a lack of training in this country of specialists at the top and middle echelon of this specialization area.

In order to correct this lag, the program recommends adoption at a number of higher educational institutions in this country of a new specialization area: "Nondestructive physical methods of testing the quality of materials, products and welds," as well as organization of training technicians in the specialization area "Quality Control of Metals and Welds."

Plans also call for expanding the publication of technical, training and reference literature in this country and organizing under the auspices of major scientific research and design organizations advanced training of engineer personnel working in the area of welding quality control.

Implementation of the measures enumerated above will produce great economic effect. It has been calculated that in welding production proper more than 650 million rubles will be saved by increasing labor productivity and decreasing production costs; 600 million rubles will be saved in the area of utilization of welded structures by reducing specific metal requirements and increasing operational reliability. As a result of this, capital expenditures will be repaid in slightly more than 3 years, which is half the normal payback period.

In conclusion we should note that the system of state planning and direction of development of welding production, which has entered its third decade, has definitely proven itself. At the present stage it is necessary only to increase the responsibility of each component of this system for the assigned task and for unconditional execution of program-established targets aimed at achieving new successes in socialist industry, economic and technological advances in the national economy of the USSR.

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MISCELLANEOUS

NEW BOOK DISCUSSES RESISTANCE TO CRACKING OF VARIOUS MATERIALS

Kiev TRESHCHINOSTOYKOST' MATERIALOV I ELEMENTOV KONSTRUKTSII: TRUDY VSESOYUZNOGO SIMPOZIUMA in Russian 1980 pp 2, 332-335

[Annotation and table of contents from book "Resistance to Cracking of Materials and Structural Elements: Proceedings of All-Union Symposium", edited by G. S. Pisarenko, Izdatel'stvo "Naukova dumka", 335 pages]

[Text] This volume contains papers presented at the All-Union Symposium (Kiev, 24-26 October 1978), which examine the criteria of failure of structural materials in the presence of advanced plastic flow at a crack apex, methods of determining the characteristics of the resistance to cracking of materials under static and dynamic loading, the influence of various factors (temperature, rate of loading, scale, environment, etc), on the crack resistance of materials, as well as application of methods of mechanics of failure to estimation of the strength and durability of materials and structural elements.

This volume is intended for specialists working in the area of strength of materials and structures employed in modern equipment.

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ECONOMIZING IN FUEL-ENERGY RESOURCES IN 11TH FIVE-YEAR PLAN

Moscow TSVETNYYE METALLY in Russian No 3, Mar 81 pp 8-13

[Article by O. N. Bagrov: "Reserves for Savings in Fuel-Energy Resources in the Service of the 11th Five-Year Plan"]

[Text] O. N. Bagrov's article discusses the most important and effective areas of implementation of the program to achieve savings in fuel and energy resources in USSR nonferrous metallurgy in light of the decisions of CPSU Central Committee plenums, the 26th CPSU Congress and addresses by CPSU Central Committee General Secretary Comrade L. I. Brezhnev, chairman of the Presidium of the USSR Supreme Soviet.

The editors believe that publication of this article will evoke a lively response on the part of our readers. We hope that scientists and experts in the USSR and the nations of the socialist community will in their responses to this article share their predictions on discovering reserve potential and will evaluate the prospects and practical measures to carry out the assigned tasks specified in this article.

Daily exchange of information on new developments and experience in adoption and improvement of production in this area will increase the effectiveness of performance of the metallurgical industry of the nations of the socialist community.

In the 10th Five-Year Plan the work forces of the enterprises and organizations of this branch accomplished important technical tasks pertaining to the employment of new and improvement of existing equipment and technology in many production processes, which resulted in decreased consumption of primary and improved utilization of secondary fuel-energy resources. In the aluminum industry economical new-design S-8BM electrolytic cells were brought on-line at the Bratsk, Krasnoyarsk, and Novokuznetsk Aluminum plants, baked anode electrolysis was employed at the Tajik, Volgograd and Volkhov Aluminum plants, and steelmaking pins obtained by explosive welding were adopted at the Krasnoyarsk, Bratsk and Irkutsk Aluminum plants; as a result savings in electric power totaled 53.2 million kilowatt hours per year.

Electrolytic cells without cathode boxes were adopted in magnesium production at all plants. Efficient reverse flow was adopted in copper and zinc electrolysis, and

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replacement of obsolete converter units with new ones employing silicon semiconductor devices was completed.

Volume of employment of oxygen (by 36 percent) and hot blast (by 40 percent) increased in pyrometallurgical production, and the trend to convert traditional pyrometallurgical processes into combined autogenous processes became definitive. For example, oxygen-flare smelting (KFP) of copper concentrates at the Almalyk Mining and Metallurgical Combine makes it possible to reduce energy expenditures by 30 percent, while kivtset* in the production of zinc at the Irtyshsk Mining and Metallurgical Combine decreases expenditure of energy resources by 30 percent.

Experimental melts of copper concentrates in a liquid bath (PZhV) at the Noril'sk and Balkhash Mining and Metallurgical combines demonstrated the potential of this process. Processes of fuming slags at the Ust'-Kamenogorsk Lead and Zinc Combine, the Chimkent Lead Plant, and the Ryaztsvetmet Plant were further perfected.

At the power and energy facilities of this branch, work was accomplished on modernizing boilers, turbines, compressors, power distribution networks, centralization of power supply and conversion of production processes over to gas.

Savings in energy resources were achieved as a result of employment of means of automation and adoption of industrial process automated control systems (ASU TP).

Employment of Karat and Potok automated control systems at the surface mines of the Yakutalmaz Association and the Sorsk Molybdenum Combine resulted in a productivity increase of 5-7 percent for excavators, 10-12 percent for truck transport, and significant savings of fuel and electricity.

Equipment utilizing secondary energy resources (VER) was brought on-stream during the five-year plan and produced positive results. A total of 99 waste-heat boilers are in operation in this branch, 171 evaporative cooling systems, and 55 air preheaters. Generation of thermal energy by heat recovery equipment has increased fourfold in the period 1966-1980.

Operational stability has been improved and fundamentally new designs of waste-heat boilers, air preheaters and evaporative cooling systems have been adopted on many operating heat-recovery installations.

At the Severonikel' Combine an RKK-20/40 waste-heat boiler was successfully brought on-line in 1979 for cooling converter waste gases. This boiler operates downstream of an evolvent spraying unit with evaporative cooling and is regulated by an automatic draft control system. This power engineering complex has made it possible to achieve efficient removal of converter gases, gas cooling, and gross dust removal in the boiler's radiation chamber with a sulfur dioxide concentration of up to 8-9 percent in the gases. And ROP-20/40 waste-heat boiler, mounted above a molten metal bath at the tail end of a furnace, without apteyka** is operating successfully.

Heat pipes are successfully being utilized at the Ust'-Kamenogorsk Lead and Zinc Combine for cooling the waste gases of rotary kilns. At the Ryazan' Nonferrous Metals Processing Plant, conversion of the slag subliming furnace to an evaporative cooling system made it possible in 1980 to shut down two steam boilers at the plant

*expansion unknown

**meaning of word not known

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with a total output of 20 tons per hour and to achieve savings of 7 million cubic meters of natural gas.

Although enterprises and institutes have had success in reducing energy consumption in the production of nonferrous metals in this branch, there are also serious deficiencies connected with delays in utilization of the results of tested and proven highly-effective measures.

There remains considerable reserve potential in nonferrous metallurgy, utilization of which can boost the level of energy utilization. Each year more than 10 enterprises in this branch overconsume fuel and energy resources: in 1980 these included the Achinsk Alumina Combine, the Bogoslovskiy, Dneprovskiy and Urals Aluminum plants, the Solnechnyy Mining and Beneficiation Combine, the Sredneural'skiy Copper Smelting Plant, the Severonikel' Combine, plus several others.

Considerable deficiencies were noted in the production of aluminum. As a result of a low level of organization of the electrolysis process, specific consumptions of electric power were not reduced in the 10th Five-Year Plan (in 1980 they were 100.28 percent of the 1976 level).

Modernization of evaporator systems at alumina plants, with adoption of multiple pulp evaporation arrangements, resulting in a sharp decrease in the specific consumption of electricity, is being carried out very slowly.

At enterprises in Kazakhstan (other than the Ust'-Kamenogorsk Lead and Zinc Combine) there has developed a tendency toward worsened utilization of secondary energy resources; in the first half of 1980 it declined by 7 percent in comparison with the corresponding period in 1975.

The know-how of branch enterprises in the employment of hot blast is not being utilized in the pyrometallurgical shops of the Noril'sk and Balkhash Mining and Metallurgical Combines. Equipping metallurgical facilities with heat-recovery installations (waste-heat boilers, evaporative cooling systems, air preheaters) and furnace heat control automation devices is progressing at an insufficient pace.

In execution of the CPSU Central Committee and USSR Council of Ministers decree entitled "On Improving Planning and Strengthening the Effect of the Economic Mechanism on Improving Production Efficiency and Work Quality," the ministry has adopted a specific, comprehensive program for achieving savings in fuel and energy resources in this branch in the period 1981-1985. Achievements in putting advanced equipment and processes on-line, utilization and dissemination of the know-how of leading work forces obtained in the 10th Five-Year Plan have been adopted as a starting point. Savings targeted in the 11th Five-Year Plan for this branch are as follows: fuel -- 4.2 percent; thermal energy -- 4.4 percent; electric power -- 2.3 percent.

Since more than 60 percent of fuel and energy resources are consumed by this branch for process requirements, the principal area on which to concentrate in improving efficiency of utilization of energy resources is improvement of existing and adoption of new energy-conserving industrial processes and equipment. Construction of new metallurgical plant facilities in 1981-1985 is to be accomplished on the basis of modern technology, ensuring more efficient energy utilization.

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The Tajik and Sayanskiy Aluminum plants, which are presently under construction, are being equipped with baked-anode electrolytic cells, with a high degree of automation and mechanization. The Nadezhdinskiy Power Engineering Complex of the Noril'sk Mining and Metallurgical Combine is designed with the employment of autogenous smelting, which provides utilization of the chemical energy of sulfur-containing raw materials for process and power generating needs. Two liquid-bath smelting units are to be constructed at the Noril'sk and Balkhash Mining and Metallurgical Combines, as well as oxygen-flare smelting units at the Almalyk Mining and Metallurgical Combine and the Sredneural'skiy Copper Smelting Plant.

No matter how great the anticipated energy efficiency of new processes and facilities, however, the overall level of energy utilization in this branch depends on improving the technology of existing plants, shops and processes, as well as on successful implementation of measures to modernize basic equipment presently in operation.

Efficient utilization of secondary energy resources, improvement of operating conditions and modernization of power equipment and centralization of power and energy supply should become the most important areas for achieving savings in fuel and energy resources. The sequence of program implementation is established according to the principle "Minimum specific capital investment -- maximum effect in achieving savings in fuel and energy resources." Calculations have shown that first priority should go to measures requiring specific capital investment not exceeding 108 rubles per ton of standard fuel, with current specific capital investment on producing fuel at approximately 100 rubles per ton of standard fuel.

This requirement is met by the following in alumina production:

intensification of sintering of the nepheline charge in rotary kilns by increasing the rate of rotation;

improvement of heat-exchange devices;

improvement of fuel combustion at the Achinsk Alumina Combine (targeted savings approximately 45,000 tons of standard fuel in 1985, with specific capital expenditures of 46.5 rubles per ton of standard fuel);

improvement in the quality of the cake and extraction of alumina as a result of optimization and automatic stabilization of charge composition and sintering conditions;

improvement in cake processing arrangements (79,000 tons of standard fuel and 79 rubles per ton of standard fuel respectively);

renovation of the calcining kiln charging unit with the aim of improving the degree of utilization of waste-gas heat at the Achinsk and Pikalevo Alumina combines, the Urals and Kirovabad aluminum plants (20,000 tons of standard fuel and 31.9 rubles per ton of standard fuel respectively);

installation of new types of condensers to calcining kilns at the Bogoslovskiy, Urals, Dneprovskiy, Kirovabad, Pavlodar and other aluminum plants (24,000 tons of standard fuel and 20.8 rubles per ton of standard fuel respectively).

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The following meet this requirement in the heavy nonferrous metals industry:

modernization of metallurgical equipment and improvement of their heat engineering conditions, adoption of air preheaters for shaft furnaces at the Kirovgrad and Karabash Copper Smelting combines and at the Ukrtsink Plant;

improvement of fuel combustion processes, conversion of furnaces to natural gas, etc;

optimization of the energy conditions of ore roasting furnaces in nickel and copper production.

Implementation of these measures in the copper and lead-zinc industry will provide a savings of 115,000 tons of standard fuel in 1981, 608,000 tons in 1985, while capital investment for modernizing metallurgical and power equipment in 1981 will total 17 million rubles.

The following measures are targeted for priority adoption for achieving savings in electric power:

modernization and renovation of basic process equipment at presently operating aluminum plants (2.5 electrolysis buildings at aluminum plants presently in operation will be converted to baked anodes);

optimization of electrolytic cell operating parameters; development and adoption of the "Elektroliz" industrial process automatic control system at six enterprises of the aluminum subbranch;

modernization and increase in the unit capacity of process equipment and adoption of industrial process automatic control systems in the production of titanium and magnesium, etc.

Implementation of these measures will make it possible to save hundreds of millions of kilowatt hours of electricity in 1981. Capital spending on these measures in 1981 will total 12.1 million rubles.

Recovery and utilization of secondary energy resources is one of the most important areas of achieving savings and efficient utilization of fuel-energy resources. By 1985, with suitable financing, sufficient secondary energy resources can be tapped to obtain 35.5 million gigajoules of thermal energy, which is equivalent to saving 1.5 million tons of standard fuel. Additional production of thermal energy by utilizing secondary energy resources will total 16.3 million gigajoules. Plans call for bringing on-line in this branch during the 11th Five-Year Plan 54 waste-heat boilers, 65 evaporative cooling systems, 28 air preheaters, and 14 units of other equipment utilizing the heat of fired coke, sintered materials, slags, etc, and to modernize heating and ventilation systems at the enterprises of this industry.

Implementation of these measures will produce savings of 2,884,200 gigajoules of thermal energy in 1981 and 18,810,000 in 1985, while required capital spending in

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1981 will total 30 million rubles, including 18 million rubles for organizing recovery and utilization of secondary energy resources.

Thus specific-purpose capital spending of 60 million rubles, in addition to centralized financing for capital construction and construction-installation work, will be required to obtain in 1981 savings of 580,000 tons of standard fuel from all categories of fuel and energy resources, including additional generation of 397,100 gigajoules of thermal energy from utilization of secondary energy resources.

The most important scientific projects, in conformity with the specific-purpose comprehensive program, are directed toward:

optimization of the heat engineering conditions of metallurgical equipment (reverberatory and shaft furnaces, rotary kilns, etc);

improvement in the designs of burner devices and fuel combustion processes;

investigation and development of waste-heat boiler designs for power engineering equipment;

development and adoption of new energy-conserving processes and equipment;

development and adoption of heat-insulating materials.

Implementation of the specific-purpose comprehensive program for achieving savings in fuel and energy resources, in conformity with party and government instructions, will require increased financing of scientific research and experimental design activities in the area of industrial power engineering. In particular, there should be achieved further development of the VNIIenergotsvetmet [All-Union Scientific Research Institute of Nonferrous Metallurgy Power Engineering] and an increase in the volume of research and development conducted by this institute in the area of industrial power engineering to 3 million rubles (as compared with the 2 million rubles targeted for 1980), with a corresponding increase in project personnel.

Automation of industrial processes and computer control of production provides considerable savings in energy resources. A systems approach to the problem of automation and further adoption of automated industrial process control systems will experience extensive development. One hundred and forty industrial process automated control systems are to be brought on-line during the five-year plan.

In the area of electrolysis aluminum production, plans call for bringing on-line 15 improved automated "Elektroliz" systems (second-generation ASU TP) in place of the previously employed "Alyuminiy" systems.

Concentration mills will be equipped with automatic analysis and monitoring systems based on the Soviet-made KRF-13 and KRF-18 X-ray spectral analyzers. An automated power engineering control system will experience further development.

Extensive employment of static rectifiers and total automation of dredges will make it possible to achieve a savings of up to 240 million kilowatt hours per year for the dredge fleet as a whole, with a simultaneous increase in equipment output.

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Considerable savings in electric power will be obtained by installing elsewhere in this industry the automated control system for industrial lead and zinc products manufacturing processes installed at the Elektrotsink Plant. Adoption of this system would ensure savings for the subbranch as a whole of 2,665 tons of coke fines and 1 million kilowatt hours of electricity per year. Movement on-line of zinc and electrolysis plant rotary tube furnace automated control systems will make it possible to save tens of millions of kilowatt hours of electricity, 16,460 tons of coke fines and 4,500 tons of standard fuel per year. Automation of ore roasting furnaces will produce great savings in electricity.

Principal sources of achieving savings in electric power at nonferrous metals processing plants will include converting the power driving rolling mills to static semiconductor rectifiers, total automation of rolling mills, and ingot diagnosis.

Adoption of a hot-rolling reversing mill process automated control system at the Kirovskiy Nonferrous Metals Processing Plant has made it possible to achieve an annual savings of 1.7 million kilowatt hours of electricity, 877.8 gigajoules of thermal energy, 41 tons of residual oil with capital outlays of 70,000 rubles; at the Sorsk Nonferrous Metals Processing Plant -- 459.8 gigajoules, 20 tons, and 42,000 rubles.

During the five-year plan 40 automated industrial products analytical monitoring systems (ASAK and ASAPP) were installed at concentration mills and in metallurgical production, systems based on KRF-13 and KRF-18 X-ray spectral analyzers and M6000 computer systems. These systems provide increased recovery of metals, savings in flotation reagents, a potential decrease in chemical laboratory staff personnel, as well as savings in electricity, taking account of additional production of metal and materials.

In the USSR nonferrous metallurgical industry the bulk of work on modernizing industrial power equipment is performed by specialized branch organizations, institutes and design offices: Energotsvetmet, VNIIenergotsvetmet, Tvetmetelektroproyekt, and subbranch lead institutes.

Specialized organizations were established initially for centralized major overhaul of power equipment. Their tasks gradually changed and broadened, and engineer services were developed, capable of engineering, designing and setting up complex industrial power equipment. Under these conditions they have begun to be transformed into qualitatively new combined production units capable of accomplishing total planning at all levels in the research-production chain.

Establishment of specialized organizations promoted acceleration of the conduct of research, design, and sometimes building of new equipment and its rapid adoption. In addition to broad specialization (power engineering, automation and gas scrubbing), these organizations also possess narrow specialization by types of industrial power equipment, which makes it possible substantially to improve the efficiency of the work they perform and to speed up the pace of modernization of industrial power and energy processes.

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Power machine building and instrument engineering established within this branch open up extensive possibilities for the broad adoption of new power equipment in the production of nonferrous metals.

In view of the great efficiency of the work done by specialized energy and power engineering organizations in the area of modernizing metallurgical production, there should be ensured further development and increase in the production capacity of power machine building and instrument engineering enterprises. Plan targets specify increasing the output volume of branch energy and power machine building in 1985 to 50 million rubles per year and instrument engineering to 30 million. Plans call for commencing the manufacture of small nuclear power supply sources, magnetohydrodynamic equipment, shop automation systems, and nuclear physics instruments.

The problem of achieving savings in energy resources is a multifaceted problem encompassing numerous areas, and therefore all available manpower and resources must be marshalled to solve it. One example is the work done by management and the workers at large at the Chelyabinsk Electrolytic Zinc Plant, which initiated socialist competition in this branch for achieving savings in fuel and energy resources. Their pledges call for implementation of an aggregate of organizational and technical measures, including recording quota setting and energy resource expenditure limits in all shops, in all processes and units, and a daily summary of performance results of shops, shifts, and brigades. Technical measures specify improving technology and power engineering. In particular, plans call for an accelerated program of utilization of secondary energy resources, which will make it possible in 1983 to meet all production needs in thermal energy with waste-heat recovery equipment.

The work forces of the Raztsvetmet and Volkhov Aluminum plants have responded to the appeal of the Chelyabinsk workers, and they are successfully carrying out comprehensive measures to achieve savings in fuel and energy resources. It is the task of all enterprises of this branch to study the experience and know-how of these leading plants and to undertake similar projects at their own enterprises.

Approving and supporting the wise foreign and domestic policy of the CPSU, the power engineers of nonferrous metallurgical enterprises and institutes, specialized organizations of the Chief Power Engineer Administration, as well as the power services of the ministry central edifice, are directing their efforts toward improving work quality and efficiency and successfully accomplishing the tasks assigned to this branch of industry by the 26th CPSU Congress.

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NEW BOOK DISCUSSES BRITTLENESS OF METALS AT LOW TEMPERATURES

Kiev KHRUPKOST' METALLOV PRI NIZKIKH TEMPERATURAKH in Russian 1980 pp 4, 336-337

[Annotation and table of contents from book "Brittleness of Metals at Low Temperatures" by A. Ya. Krasovskiy, UkSSR Academy of Sciences, Izdatel'stvo "Naukova dumka", 340 pages]

[Text] This monograph discusses, from the standpoint of the physics and mechanics of failure, phenomena of brittle and fatigue failure of metals at low temperatures. The author analyzes the stressed-deformed state of a material at the apex of a crack in the absence and presence of a plastic zone and related macroscopic criteria of failure. The author analyzes on the basis of modern advances in solid-state physics the processes of development of plastic flow at the apex of a crack and microscopic criteria of failure of metals, as well as the processes of propagation of fatigue cracks.

This volume is intended for scientists, engineers and technicians with an interest in the problem of brittleness and fatigue of metals.

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ELECTRODE PROCESSES AND TECHNOLOGY OF ELECTROCHEMICAL DIMENSIONAL PROCESSING OF METALS

Kishinev ELEKTRODNYYE PROTSESSY I TEKHNOLOGIYA ELEKTROKHIMICHESKOY RAZMERNOY OBRABOTKI METALLOV in Russian 1980 (signed to press 24 Jun 80) p 143

[Table of contents from book "Electrode Processes and Technology of Electrochemical Dimensional Processing of Metals", Izdatel'stvo "Shtiintsa", 1,110 copies, 144 pages]

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