

SEMINAR ON DIFFUSION SATURATION AND COATINGS
AT THE SECTION ON PHYSICOTECHNICAL PROBLEMS
OF MATERIAL SCIENCE, ACADEMY OF SCIENCES
UkrSSR

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The eighth All-Union continuously operating seminar on diffusion saturation and coatings organized by the Section on Physicotechnical Problems of Material Science, Academy of Sciences UkrSSR, was held in September, 1968, at the Odessa Polytechnical Institute, MVSSO, UkrSSR. More than 200 scientific personnel from 60 organizations attended.

The seminar heard 67 reports and communications on theoretical and practical problems of surface alloying and protective coatings on various metallic and nonmetallic materials.

The opening address was given by doctor of technical sciences G. V. Zemskov, in which he noted that the continuously operating seminar organized in 1967 has become a scientific center combining the efforts of scientists working in the area of chemicothermal treatments and coatings.

The review by G. V. Samsonov (Institute of Problems of Material Science, Academy of Sciences UkrSSR) concerned the theory of diffusion processes. Using the model of the configuration of localized valence electrons, he analyzed heterodiffusion parameters in metal-metal and metal-nonmetal systems. He showed that the activation energy and diffusion coefficient depend on the character of electron transfer between atoms of diffusing substances. The activation energy decreases with increasing probability of the formation of energetically stable configurations by atoms of the diffusing components. The structure, character of the defects, and size of the atomic radius, which are determined by the character of the electron structure, are secondary properties of the substance being used to describe diffusion processes.

Reports by I. N. Kidin, V. I. Andryushechkin, and others (Moscow Institute of Steel and Alloys) concerned problems of chemicothermal treatment of steel during accelerated electrical heating. It was shown that rapid heating increases the diffusion susceptibility and chemical activity of austenite, which allows the chemicothermal treatment to be shortened.

The mathematical description of diffusion saturation processes of metals was the subject of reports by L. F. Sokiryanskii, G. V. Shcherbedinskii, L. A. Kondrachenko, V. I. Borisov, V. T. Borisov, and others. A solution of the diffusion equation was proposed for successive saturation of a pure metal with two elements in the region of solid solutions.

Nitriding of refractory metals and stainless steels was described by V. D. Yakhina, Yu. V. Sorokin, O. G. Pakharenko, and G. S. Kaplina.

Diffusion vacuum chromizing was considered in reports by L. V. Rogova, Yu. A. Belov, A. P. Mokrov, A. P. Yuodis, and N. M. Kozakov. The vacuum diffusion process makes it possible to obtain a deep diffusion coating of chromium on steels.

The temperature conditions for the formation of thin vacuum coating were given by M. V. Belous. It was found that the condensate on the substrate is warmed by the heat of sublimation, which is one reason for rapid diffusion in thin films.

Yu. A. Belov and I. F. Afonskii examined chromizing in pastes. They proposed that the retort be filled with cast iron chips, which facilitates the diffusion of chromium into the part.

Among the reports on aluminizing, that by D. A. Prokoshkin, B. N. Arzamasov, et al., was especially noteworthy. They used the circulation method for aluminizing nickel and its alloys. They studied the variation of the thickness and structure of the layer with the gas flow rate and the effect of turbulence

Translated from *Metallovedenie i Termicheskaya Obrabotka Metallov*, No. 3, pp. 76-78, March, 1969.

on the quantity of the coating. They presented a method of calculating the optimal rate and gave recommendations for the gas flow conditions in circulating apparatus.

There were several reports on diffusion boriding. L. T. Voroshnin investigated the effect of alloying elements on the formation of the transition zone and showed that alloying can affect the structure and properties. I. S. Dukarevich and V. P. Smirnova studied the distribution of carbon in borided layers by the radioactive isotope method. They found that carbon is almost completely expelled from the zone of borides and saturates the transition zone to a depth that is three to four times the depth of the boride zone.

G. L. Zhunkovskii presented an original method of studying the effect of alloying elements on chemicothermal treatment processes. V. I. Pokhmurskii and V. S. Zamikhovskii showed, that, depending on the chemical composition, boriding may increase or decrease the resistance of steel in air and corrosive media. Reports on electrolytic boriding (S. Ya. Pasechnika, A. A. Afanas'eva, et al.) concerned the intensification of this process. It was proposed that a reversed flow be used in a melt of borax, boric anhydride, sodium fluoride, and sodium chloride.

Many reports were given on multicomponent protective coatings (O. V. Lokatosh, A. V. Kostenko, Yu. K. Belov, Yu. A. Guslienko).

The basis of the combination of the coating and the substrate is the adhesion interaction or gripping of these materials. This problem, which is important in the theory and practice of chemicothermal treatment, was the subject of the report by A. P. Semenov, in which he described a method and apparatus making it possible to study the surface interaction of materials at high temperatures (up to 1200°C) in vacuum, inert and gaseous media, and to study diffusion saturation, hardness, the mechanical properties, friction, and wear.

Reports were also given on the operating characteristics of protective coatings.

Considerable research was done on the further improvement of complex diffusion saturation of metals and alloys with different elements, the diffusion saturation mechanism and the interaction of the components in the original composition of the coatings, the structure of the coatings formed, and protective coatings with a number of advantageous technical characteristics.

Many of the reports led to discussions. It was resolved to publish the transactions of the seminar and hold the ninth seminar in September, 1969, in L'vov.