



KORRÓZIÓS FIGYELŐ

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SYNOPSIS OF THE PAPERS IN THIS ISSUE***Langmuir-Blodgett layers in microbiological corrosion***

by T. Rigó, J. Telegdi, J. Beczner and E. Kálmán

With Langmuir-Blodgett technique we laid the organic molecules on a solid carrier as an orderly and solid phase. The method is simple and the layer thickness can be controlled so we can form an appropriate featured orderly layer from the organic materials. Examining the layers we found that we get the most massive films on pH 5.6 and 20 °C.

We made appropriate quality Langmuir-Blodgett mono and multi layers from various materials under different conditions and we examined the layers. With microbiological and surface check experiments we proved that certain molecules block the adhesion of microorganisms. Thus they can be used for lifetime increasing of structural materials.

Spottiness of cold-rolled aluminium sheet

by T. Török, Z. Fecske, R. Márkus and D. Takács

Spottiness of cold-rolled and ball-pressed aluminium sheet was studied. Causes, prevention and reparation of spottiness were included in this investigation. It was established that there are two causes of spottiness: staining by oil used for cold-rolling and deposition of moisture. It was concluded that the

cooperation with the supplier of packing material and the compliance with the rules of storing and transportation are important in the prevention of corrosion damage.

Something about the flue gas corrosion

by M. Horváth

At the combustion of fossil fuels including of dangerous and non-dangerous wastes the flue gas can causes significant corrosion. The degree of corrosion depends on the temperature and the oxygen, sulfur, chlorine and other components of the flue gas. Controlling the temperature of chimney and using resisting structural materials is the best way to corrosion protection.

Corrosion protection of steel bridges

by M. Vértes

The Quality Control Department (MVO) of ÁKMI Kht. in Győr has done control examinations on public road constructions and renovatings since march 1, 1993. The controlling areas are: paint quality, paintwork control, final control, coating lastingness. The article shows examples from these experiences on bridges in Hungary.



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SYNOPSIS OF THE PAPERS IN THIS ISSUE

Misleading concepts in the cathodic protection diagnostics by Z. Lukács jr.

There are a number of measuring methods applied in the cathodic protection which cannot be verified either from a theoretical or from a practical point of view. It can be shown that the measurements taken at the test points do not prove the correct operation of the cathodic protection system. One of the measuring methods (CIPS) is capable of providing evidence of the effectiveness only in the two- or three-electrode versions which cannot be applied in practice in a number of cases. The other method (DCVG) is applicable only for the qualification of the coating but not for the qualification of cathodic protection. Evaluation and usefulness of the specific conductance of soil measurements, applied with, or (in an increasing number of cases) instead of the CIPS surveys, are discussed.

Features of corrosion protection for bridges by Á. Földes

The profession of corrosion protection for bridges includes special connections and requires custom planning devices and effector solutions. Cooperation between bridge designers and corrosion protection specialist are the conditions of the successful work. The article tries to describe 4 themes:

1. The principles of selecting the adequate coating system.
2. The special structures which require higher carefulness at the planning process.
3. The safety factors to be included into the construction.
4. The environmental and traffic theory considerations which make corrosion protection more difficult.

Contributions to study and control of corrosion of pipelines due to AC stray currents by J. Lingvay

The present paper deals with various aspects concerning AC corrosion phenomenon such as AC stray

currents origination, influence of alternating signals on the kinetics of the corrosion reactions, specific methods worldwide destined for corrosion mitigation. Also, an original method developed in Romania and which is high efficient is shown. Thus, the method ensures: electric safety of metallic pipes to hazardous/random charges with undefined polarity and which generate dangerous voltages (lighting strikes inclusively), polarized drainage of stray DC currents, treatment of stray alternating currents by their rectification and transforming in protection cathodic current, therefore increasing of cathodic protection effectiveness.

Application of sacrificial anodes to protect polyethylene coated high-pressure gas pipelines by P. Janitor, K. Koóš

The application of good quality materials and up-to-date technologies bring new possibilities in corrosion protection of gas-distributing pipelines. The good quality polyethylene coatings make the profitable cathodic protection building and operating possible. The practical possibilities of sacrificial protection of high-pressure gas pipelines have also tried.

Up-to-date metallurgic surface treatment and methods for waste management – On-the-job training in the North-Hungarian area by T. Török

The knowledge and expertise accumulated during the years at the Department of Nonferrous (Extractive) Metallurgy in the field of chemical metallurgy can be harnessed and exploited well in studying some elements of advanced surface technologies, which are so important in the finishing operations of many industrial products. Based on that knowledge, this interdisciplinary subject is also offered to university students of all levels. Moreover, the departmental research group is also striving to become one of the significant educational and research centers of surface coating techniques in the Northern region of Hungary.



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SYNOPSIS OF THE PAPERS IN THIS ISSUE

Equipment and computerized evaluation technology for close interval potential survey (CIPS) on cathodic protection of pipelines

by Z. Lukács jr., L. Gábor and Gy. Fodor

The Close Interval Potential Survey (CIPS) has been applied for a long time to determine the level of protection and the distribution of potential and the coating defects on cathodically protected pipelines. Several technologies with minor differences in the details have been developed for this important diagnostic method. The general use of PC has raised a claim for the computerized evaluation of the great number of measurement data obtained in these surveys. To the best knowledge of the authors, in spite of the obvious need for increasing the reliability of the measurement evaluation, no matching technology has emerged so far. The authors of this paper have designed the equipment CIPS-401 and the related evaluation software with the following features:

1. The measurement technology is designed to measure data from which the following parameters can be computed:
 - a. Measuring point suitability factor.
 - b. The corrosion potentials at the detected coating defects.
 - c. The ratio of switched and not switched current (foreign current ratio).
 - d. The resistance of the measurement circuit.
2. The data acquisition, handling and evaluation is carried out in accordance with the corresponding rules of mathematical statistics. Consequently, a suitability factor is calculated which enables the evaluation software to weight each measurement point, eliminating all false information and running the whole evaluation process without the necessity – and possibility – of any human interaction, thus minimizing the possibility of subjective errors, artifacts and eventual mishandling of data.
3. The measurement and evaluation data are stored in database.
4. Optional GPS connection is feasible.

The performance of the technology is demonstrated on evaluated measurement data. The theoretical background and the mathematical procedures are discussed.

Repairing of pipelines under pressure with glass-reinforced unsaturated polyester

by V. Kajtár, J. Maros, Á. Szilágyi,
Gy. Kollár and P. Gara

This article surveys processes developed for renovate corrosion damaged pipelines which are used for

transport different materials especially oil and gas. Theoretical and practical experiences of developing a composite material are also introduced. A glass-reinforced composite material has been given as a result of the improvement, and it is suitable for apply as a bandage in more layer at the surface of the damaged pipe. Under repair, operation parameters (temperature, pressure of the streaming fluid etc.) are not needed to restrict.

Lifetime increase of insulations and control of corrosion of underground medium voltage power cables

by J. Lingvay and J. Kovács

The degradation process of metallic shields of underground power lines is an important factor upon their maintenance, reliability and safe operation. Therefore, the paper presents theoretical aspects concerning the electric phenomena taking place in cables' insulator/dielectric, the kinetics of corrosion reactions of metallic sheaths and original technical solutions for control of corrosion and increase of insulating resistance of underground power cables operating in aggressively electrochemical media/soils (electromagnetic polluted by DC and AC stray currents, soils of high salinity and/or bacteriologic charge, deep waters etc.). Also, there are presented the application schemes of our method for single – wire cables, three – wire cables and other underground power lines using different types of cables. Some implementation examples are presented too and the results of the method are emphasized. It clearly appears that the application of our technology lead to the mitigation/elimination of degradation risk of metallic screens, a progressive improvement of the insulation resistance of power lines and implicitly of their maintenance and reliability.

Hungarian experiences of "NO-DIG" processes in Umwelt-Technik Ltd.

by A. Lőrincz

In Hungary, more and more public service operator uses "NO-DIG" process for renovating the pipeline systems without excavation. Before application, wide analysis is needed to find the appropriate device for the given task. The low price should be only the secondary aspect against high technological content and lifetime. Increasing durability of facing material and cutting costs of completion are the primary purpose on developing the technology. In the future, "NO-DIG" technology has to be fast and easy for any size of pipelines.



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SYNOPSIS OF THE PAPERS IN THIS ISSUE

Pilot apparatus for testing drinking-water quality changing – The effect of neutral salts upon dissolution of copper

by D. van Loyen, W-D. Schulz,
J. Meyer and W. Nissing

Modified drinking water order has become effective with more strict limits in January 1, 2003. in the German Federal Republic. Test equipment, process and the evaluation is specified in the DIN 50931–1 specification to determine long-term water load caused by corrosion product originating from the domestic equipments. Korrosionsschutz Dresden Company has built computerized test equipment according to the specification.

This paper shows the first results, measuring and evaluations plotted against sulphate, chloride and hydrocarbonate concentration and pH. Effect of orthophosphate is taken into consideration for decreasing corrosion rate of copper. The first results of testing of neutral salt effects show that sulphate and chloride in treated surface water without carbon dioxide does not increase solubility of copper. Higher carbon dioxide concentration in water causes higher copper content besides comparable sulphate concentration. Dosing orthophosphate immediately decreases the solubility of copper. With this equipment, the opportunity is given to examine copper, brass and copper casting appliances.

Ideas about formation mechanism of two- and poly-metallic systems combining on boundary surfaces

by S. Szabó and I. Bakos

Two- and poly-metallic systems combining on boundary surfaces play a significant role in machine engineering, metal catalysis, metal corrosion, electroplating, hot-dip galvanizing and metallization industry. The article summarizes those industrial processes which manufacture two- and poly-metallic systems combining on boundary surfaces. In these technological processes the main reaction mechanism is the metal adsorption onto other metal surfaces. The first reaction step is taking the metal into the domain of atomic binding force at the surface of the other metal. We are classifying the industrial processes on the basis of this reaction step. The second step is the formation of adsorption binding between the two metals which provides strong adhesion. The third step – especially on high temperature – is the absorption mechanism (alloy generation, interdiffusion). Realization and scientific exploration of metal adsorption is the result of the latest decades so this reaction step is partially or totally missing from the older technological descriptions and it is explained with adhesion or interdiffusion.

Effects of a chemical decontamination procedure on the corrosion state of the heat exchanger tubes of steam generators

by A. Szabó, A. Mátyás, K. Varga,
K. Radó, Z. Németh, D. Oravetz,
É. Makó-Kristóf, Z. Homonnay,
E. Kuzmann, J. Schunk, P. Tilky,
F. Oszvald and G. Patek

In the present work, a comprehensive study of the corrosion state of the heat exchanger tubes originating from 17 different steam generators of Paks NPP (Hungary) was performed. While the passivity of the inner surface of 22 stainless steel specimens was investigated by voltammetry, the morphology, chemical and phase compositions of the oxide layer formed on the surface were analyzed by SEM-EDX, XRD and CEMS. Based on the measured corrosion characteristics (corrosion rate, thickness and chemical composition of the protective oxide-layer) it was found that these parameters strongly depend on the decontamination history of steam generators. AP-CITROX technology does exert a detrimental effect on the general corrosion state of steel surfaces and a "hybrid" structure of the amorphous and crystalline phases is formed in the outermost surface region. This "hybrid" structure of the surface constituents exhibits great mobility into the primary coolant under normal operation of the VVER type reactor.

Contributions to some permanent ground plate's conception and realization

by J. Kovács and J. Lingvay

Ground plate's maintenance and electro security afferent to electro energetic system is determined by pipes and thermal zinc plated strips from which these are traditionally realized. On the other hand, in some situations, especially in crowded urban centers the available space for ground plate's realization is rather small and/or the soil's conductivity is increased rising distinct problems in ground plates designing and execution (with an imposed dispersion resistance).

In this paper we are presented with a new kind of ground plate which needs little space for realization. These ground plates are realized out of alloy modules specially conceived (with very low dissolution rate – under 0,5 kg/A-year when passed through by an electric current, even in anodic polarized DC) to function in electrolytic (different soils) aggressively increased environments. The ground plate is being realized in vertical frame, only in one location.



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P. Halmos, Z. Homonnay, E. Kuzmann,
J. Schunk and P. Tilky

Heat exchanger tubes (4 specimens) provided by Paks NPP Ltd. (Hungary) were investigated in order to study the efficiency of oxide layer removal, as well as the corrosion and solution chemical effects of the FRAMATOME CORD-UV technology. Decontamination factors of the treated surfaces were determined by γ -spectroscopic methods. The average corrosion rates of the inner surface of the heat exchanger tubes were measured by potentiostatic polarization technique. Modifications of the morphology, chemical and phase composition of the oxide layer were studied by SEM-EDX, XRD and Mössbauer Spectroscopy (CEMS) methods. The amount of disperse (colloid) and/or dissolved corrosion products removed from the tube surface into the solutions during the chemical cleaning procedure and the boric acid treatment was analyzed by ICP-OES and gravimetric methods.

The above studies reveal that the decontamination efficiency of the present version of the CORD-UV technology is basically low. The CORD-UV procedure does not exert detrimental effects on the passivity (average corrosion rate) of the inner surfaces. The thickness of the oxide layer removed is decisively dependent on the chemical composition and stability of the surface oxide layer as well as on the appropriate application of the CORD-UV technology.

Test of coatings with thermodielectric spectroscopy

by A. Baczoni, F. Molnár and L. Mészáros

The paint coatings structure is changing, when it get some stress, for example light, moisture or oxygen. This

structure changing can be physical or chemical, but in all cases this effect can be follow with dielectric spectroscopy.

A thermodielectric spectroscopy have built with some own instrument attachment. The whole system's control program was written in LabVIEW graphic development system as a virtual instrument. The virtual instrument is an application on the PC which control and synchronize the own instruments during the measurement.

Some test was measured with the instrument to examine some paint and the paint's adhesive. The valuation of the thermodielectric and the impedance spectrum we could verify that the constructed instrument has the ability to examine the polymer structure of paint coatings.

Alternative Cr(VI) containing chroming electrolyte in industry

by H. Vermeşan, E. Grünwald
and G. Vermeşan

Wide industrial spreading and applicability of electro galvanizing is due to excellent features of the chrome layer. However nowadays it is tried to replacing hexivalent chrome to other agents.

The experiments head to two ways: first developing clean technologies for example CDV-, PVD- and special thermo chemical processes and secondly processing hard alloys which can be electro galvanized and can substitute hard chrome coatings. Such are wolfram and cobalt alloys and dispersion layers.

In the end, according to a French study, hard chromium plating of automotive parts can be replaced with 1% carbon containing CrC layer produced in vacuum.



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SYNOPSIS OF THE PAPERS IN THIS ISSUE

Historical review of the theory of cathodic protection

by L. Krivián

The first variant of the theory of cathodic protection was developed before the discovery of electrochemical principles. The second variant of the theory was based on the Faraday's laws. The study of corrosion types refined the mechanism of corrosion and resulted an improved theory of cathodic protection. The problems of measuring techniques used for the control of cathodic protection have raised the imperfectness of electrochemical terms. Consequently new corrosion terms were introduced in the theory of corrosion. Summing up the results the theory of cathodic protection and corrosion were mutually developed.

Examination of corrosion damage caused by electric traction of Bucharest underground

by J. Lingvay

By specific electric and electrochemical determinations, there have been measured as well the DC stray currents provided by the metro's railroad as the AC stray currents provided by the Bucharest's metro power supply system. There also, have been evaluated the state of corrosion of the metallic structures afferent to metro's tunnels and railroads. By analyzing and processing the obtained experimental data, it resulted that the metallic structures afferent to the metro are, localized, strongly affected by the corrosion, this mainly being due to the stray currents circulation.

Adsorption phenomena on polycrystalline gold electrode modified by Zn-adatoms

by R. Marczona and K. Varga

In this paper, we have presented some findings obtained by the in situ radiotracer and voltammetric studies of the adsorption of anions on a gold electrode, and have reported a novel detection method for the Zn-deposition via measurement of the intensity of β^+ -particles (and the induced secondary radiations) emitted by ^{65}Zn .

The main conclusions which can be drawn from the experimental results are as follows:

1. The extent of $\text{HSO}_4^-/\text{SO}_4^{2-}$ adsorption on polycrystalline gold electrode in the pH range of 0.0–4.5 is primarily dependent upon purity of the system (solution and surface) studied.
2. An enhanced $\text{HSO}_4^-/\text{SO}_4^{2-}$ adsorption is observed in NaClO_4 supporting electrolyte (pH = 4.5) on polycrystalline gold electrode modified by Zn adatoms. At lower pH values ($0 < \text{pH} < 4.5$) no similar effect can be detected.
3. No enhanced adsorption of Cl^- ions can be measured in the pH region of 0 to 4.5) in HClO_4^- , NaClO_4 and KH_2PO_4 supporting electrolytes.
4. No enhanced adsorption of $\text{HSO}_4^-/\text{SO}_4^{2-}$ ions is detected on Au_{poly} modified by Zn adatoms in KH_2PO_4 supporting electrolyte (pH = 4.5). At the same time a significant and potential dependent deposition of Zn^{2+} ions at $E < 0.05$ V can be measured by in-situ radioactive labeling (^{65}Zn).
5. The specific of adsorption strength of the studied anions are as follows
 - a. on polycrystalline gold:
 $\text{Cl}^- > \text{H}_2\text{PO}_4^- > \text{HSO}_4^-/\text{SO}_4^{2-} \gg \text{ClO}_4^-$
 - b. on polycrystalline gold modified by Zn adatoms at pH = 4.5:
 $\text{H}_2\text{PO}_4^- > \text{HSO}_4^-/\text{SO}_4^{2-} > \text{Cl}^- \gg \text{ClO}_4^-$

Developments in thickness measuring

by G. Mohácsi

There are many methods are well known to measure thickness of coatings. Choosing the best is depending on the type of substrate and coating, the shape and size of the subject and the expenses. The most wide-spread methods are the followings:

1. non-destructive dry layer-thickness methods like magnetic, eddy-current, ultrasonic and micrometer measurement
2. destructive dry layer-thickness methods like cutting and gravimetric (mass measuring) methods
3. wet film measuring.

This paper presents the latest developments.