



KORROZIÓS TUDÁS

XLV. évfolyam

2005

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SYNOPSIS OF THE PAPERS IN THIS ISSUE***Fundamental aspects of the theory
of cathodic protection***

by L. Krivián

Cathodic protection is an accepted method for the protection of steel structures in neutral corrosive environment. This paper presents a summary of its fundamental theoretical aspects, using the latest concepts of corrosion. It can be concluded that the protective effect of cathodic polarization is realized by the reduction of corrosion agent (e. g.: dissolved O_2) at the cathodic surfaces decreasing the corrosion current in the corrosion cells. The checking of the effectiveness of cathodic protection is also an important topic. The reliability of the measurement is also outlined.

***Non pollutant heat treatment technologies
in surface protection***by H. Vermeşan, E. Grünwald
and G. Vermeşan

This paper analyzes some non pollutant ("clean") heat treatment technologies (SURSULF, SURSULF-OXINIT, ARCOR) for replacing some old polluting technologies. Corrosion behaviors of the samples after applying the new technologies were analyzed. It was found that after applying the new technologies the results shows that the corrosion resistance is bigger than galvanic depositions. The transformations in the superficial layer are analyzed to explain the good corrosion resistance.

Corrosion aspects of drainage in Köröshegy motorway bridge
by J. Horváth

The Köröshegy viaduct has been building as a continuation of M7 highway. This significant construction in view of its size and building-up will be a unique structure. This article discusses the corrosion problems of selecting materials of the drainage pipeline system. Also explains how many different factors have to be taken into consideration during the planning.

Corrosion protection of tied cantilever bridges
by G. Sevoz and M. Borbás

This exposé first of all shows corrosion aspects of cable systems used in tied cantilever and arch bridges developed by Freyssinet Company France. The Rába river bridge in road nr. 8 was built with similar cable systems and also two Danube bridges (one in Dunaújváros and another in south part of Szentendre island) will be constructing with this technology. The paper presents the evolution history of tied cantilever technology from the beginning till now day up-to-date applications.

***New system and rules of corrosion planning
and corrosion expert***
by M. Tompa

As joining to EU, regulation of planning and expert competence has to be modified. Before 1st of May, executive decree and law modification has been issued with consulting professional chambers. The complete rules had not worked out; this paper presents the conceptions and the regulations that had already elaborated.



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SYNOPSIS OF THE PAPERS IN THIS ISSUE***The impact of stray currents of electric traction over the environment.***

by Z. Puklus, J. Lingvay and L. Hodossy

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 Budapest's millennium underground railroad power supply system. There also, have been evaluated the state of corrosion of the metallic structures afferent to underground railroads galleries. By analyzing and processing the obtained experimental data, it resulted that the metallic structures afferent to the Budapest's millennium underground are, localized, strongly affected by the corrosion, this mainly being due to the stray currents circulation.

Complex survey method for condition of cast iron pipes

by M. Horvátth and N. Mátravölgyi

Cast iron water pipes have been applied for 140 years in Budapest. Knowing its condition is important for the plan of reconstruction. This article summarizes the corrosion processes of cast iron and the classifying methods of corrosion aggressiveness of soil. It describes the problematic of NDT methods and the applied wall thickness measuring methods including of the Australian Broadband Electro Magnetics method developed by Rock Solid Company and the external graphitization measuring method developed by Vekor Ltd. We have done 147 grey cast-iron pipeline examinations with excavation and environmental influence test. We took a sample of soil in every scene and examined in laboratory. We measured the potential of the structure and the electric field strength on the ground and estimated the grade of stray current. With the gathered data we have made correlation analysis. In our opinion, the parameter which most characterizes the

corrosion process is the measured deepest external graphitization. This parameter shows little correlation with original and minimal specific soil resistivity, with degree of humidity and the redox potential of soil. We worked out a scoring method with the most important parameters to form an opinion of environmental effect. This method did not give enough safety to appreciation the corrosion advances, therefore we took grade of graphitic corrosion into consideration when estimates the corrosion danger.

New environmental related trends in surface preparation and paint application and their effects on selection of coating systems

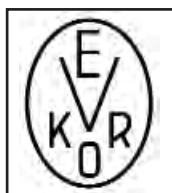
by E. Mikkelsen

The article discusses the new developments in surface preparation methods including of closed abrasive blasting and ultra high pressure water-jetting. Now days water-jetting is one of the most significant method therefore new ISO specifications have been made. The paper also presents the new coating system developing conceptions above all the waterborne coatings. Also deals with problems of existing coating maintenance, and the selection problematic of topcoat layers.

Paints can be applied near freezing-point

by Gy. Révai

Few decades ago, painting was the task of late spring and early fall terms. The latest year's economical increase requires expanding the painting period to the whole year. In the northern countries, paints that also can be applied near freezing-point have become more significant. Several foreign coating manufacturer companies offer their products to solve this problem. This article summarizes these solutions.



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SYNOPSIS OF THE PAPERS IN THIS ISSUE

Reconstruction of extra water preparation mixed bed ion exchangers and quality improvement of distilled water

by Á. Doma and G. Lozsi

Extra water preparation mixed bed ion exchangers are regenerated with sodium hydroxide and sulphuric acid. The regeneration of anion and cation exchanger resins is happen in the same column therefore certain cross regeneration is inevitable. This fact increases the sodium and sulphate concentration of produced distilled water. Because of operating time elongation of nuclear power plant blocks it is essential to keep the water quality of heat exchangers in the best level possible.

To achieve the purpose above, we changed the charge of mixed bed ion exchangers into triple bed column. Beside anion and cation exchanger resin, inert resin has been placed. These resins can be found mixed during operation, and we hermetically separate the three resins before regeneration. Thus inert layer goes between anion and cation exchanger layers and eliminates the cross regeneration. To compare the parameters of distilled water produced by the old and the new exchanger column it is stated that the sodium and sulphite concentration became smaller.

Corrosion prevention of aluminium alloy by using electroless nickel layer

by D. Takács, L. Sziráki and T. Török

In this study – after the short overview of the theory of electroless nickel plating – the effects of pretreatments on corrosion properties of electroless nickel layers were investigated by polarization measurements. In addition to corrosion resistance the deposition rate and thickness of the nickel layers were also tested by scanning electron microscopy and mass measurement. After Zn, Ni and hypophosphite immersion pretreatments the Ni-P layers were deposited from a slightly acidic electroless nickel solution which contained nickel sulphate and sodium hypophosphite as reducing agent. The results of measurements show that the pretreatments have affected the corrosion properties, the morphology and the rate of deposition. Compared to the direct electroless plating on the aluminium alloy AlMg2 the hypophosphite sublayers have increased the corrosion resistance in 0,5 mol/dm³ Na₂SO₄ (pH = 3) solution and increased the rate of deposition. While the Zn and Ni immersion sublayers also increased the corrosion resistance but decreased the deposition rate of the electroless nickel.

Colors in the surface protectionBy H. Vermeşan, I. Blebea,
E. Grünwald and G. Vermeşan

From the ancient times people would like to create nice environment among us therefore color and shape of products always were significant. The surface represents direct connection between man and his environment and sometimes determines our daily life style. From the beginning of our civilization people were always looking for the possibilities to change the surface of the products using the newest materials and technologies.

In this paper we shortly present the decorative coatings including of physical vapor deposition process which can replace toxic electroplating technologies in the near future.

Degradations by corrosion of the underground concrete steel structures

by J. Lingvay and J. Kovács

We have analysed the corrosion degradation of concrete steel structures and the reparation costs of corrosion-caused damages. We have studied the degradation mechanisms and accelerating factors of underground concrete steel structures. From our studies it emerges that the corrosion of great dimension underground concrete steel structures, frequently used at cities infrastructure constructions, is determined by the simultaneous action of hydrostatic pressure of groundwater, micromycetae and by stray currents (in a.c. and d.c.).

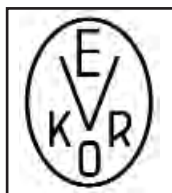
Accelerated and exposition corrosion test experiences of water-borne coatings prepared from different type of bindings

by B. Lengyel and É. Fekete

Wet-warm and salt spray testing is widely applied for quick judgement of corrosion protection ability of coating systems, thus expected lifetime can be appreciated. Water-borne coatings have shown weaker protection ability during the accelerated corrosion tests than the practical experiences show.

In our latest paper we have related that protecting properties of a certain water borne coating system becoming much better during 1 year room temperature conditioning and 1 year exposition. The same effect was achieved with heat ageing and water flooding.

In this paper we discuss, how does the binding type influence these favorable effects above.



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SYNOPSIS OF THE PAPERS IN THIS ISSUE

Deposition and industrial application of zinc contained ternary alloys

by B. Caius-Cassius and E. Grünwald

Producing and using ternary zinc contained alloys make headway against in industry, especially the CuSnZn and the innovative ZnCoCrSiO₂ systems. These systems have excellent corrosion resistance features. The article enumerates the characteristics and appropriate deposition parameters of these alloys. Testing the ZnCoCrSiO₂ alloy can be stated, that the excellent corrosion resistance features are due to the Co-content, small Cr-content and nano-size colloidal flint content which reduce the active surface. The electrolyte contains non toxic metallic salts. There are no complex compounds or complexing agents in the solution. Further experiments are in progress.

About polarity reversal of zinc-steel corrosion cell

by S. Szabó and I. Bakos

Based on a theoretical analysis of the experimental observations of the polarity reversal of zinc-steel galvanic couple, it can be stated that, under atmospheric conditions, polarity reversal is caused by zinc passivity and by the oxygen dissolved in the corroding solution, and catalytically activated by zinc corrosion products responsible for passivation. Without catalytic activation of oxygen by zinc corrosion products, polarity reversal would not be observed. When zinc is passivated, in the presence of oxygen it behaves as an oxygen electrode, and for this reason, instead of protecting iron, under the conditions of polarity reversal the zinc accelerates iron corrosion.

Features of corrosion cell and the change of its polarity

by L. Krivián

Referring to the papers of Sir Humphry Davy the operation of corrosion cell is analyzed.

Important conclusions are the followings:

- The corrosion generally proceeds in changing physical and chemical condition by more chemical reaction.
- The corrosion product may initiate further chemical reactions.
- The heterogeneity of the metal and the deposited corrosion products passivate a part of the metal producing corrosion cells.
- The macroscopic corrosion cell increasing the cathode/anode ratio generates pitting corrosion.
- If the passivated part of the metal promotes the reduction of corrosion agent, becomes cathode thus changing the polarity of corrosion cell and further increasing the local rate of corrosion.

Experiences of supervising surface protection works

by A. Molnár

Steel structures placing in air or water or under the ground suffer corrosion damage. To avoid this damage, steel structures need to protect against effects evoke corrosion processes. Usually coating systems are used. In this article those faults are presented which is committed during surface protection work of outdoor steel structures. Surface treatment of these structures made by hand or by machinery. In this case, according to the specification MSZ ISO 8501-1:1995 the degree of surface purity is at least St2. there can be well adhesive, non rusted old coating remainders in the surface. The mistakes of the surface protection work can be the followings: fault of surface treatment, selecting unsuitable coating and mistakes during painting.

Corrosion protection of hot-dip galvanized surfaces with paint coat

by G. Hegedűs

Expected lifetime of hot-dip galvanized steel structures can be essentially increased with paint coatings. According to our experiences, this painting work should be placed into the manufacturing process, because the conditions and the quality of coating is better in the workshop. The duplex coating well unites the advantages of hot-dip galvanizing and painting. If the protection of the old steel structure is only galvanization without paint, it's worth making the paint coat as soon as possible.

Contributions to the Study of Biodiversity in the Bucharest Subway Tunnels

by K. Öllerer and J. Lingvaj

The degradation by corrosion of concrete steel structures is the determining factor of their safe exploitation. Therefore, from the practical point of view, the study of the degradation mechanisms is important. The degradation by corrosion of concrete steel structures is determined by the simultaneous action of the determining factors. The practical experience evidenced that the (micro)biological factors have a great role in the initiation of the degradation process. The Bucharest's subway concrete steel structures evidence many degraded area, therefore we have studied the biodiversity of one subway sector. From the study and the collected samples results that on walls of the analyzed sector there are simultaneously present the process initiating fungi and bacteria and representatives of inferior plant groups. On greater moss samples we have also evidenced acari. All this results suggest that the natural, primary succession can be evidenced in the studied subway tunnel.



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Comparative test of bridge coatings

by M. Horvátth and V. Zanathy

This article relates laboratory accelerated corrosion test and comparison of 14 coating system suitable for bridge corrosion protection. The laboratory has received samples with several coating without naming, only marked with letter codes for the tests. The stresses were standard salt spray testing, humidity cabinet, xenotest and immersion into 3% NaCl solution. The evaluation of samples has happened according to the specification with visual check, pull-off test for adhesion, hardness, brightness and color measurement. For identification of the coating systems, infrared spectroscopy, derivatography and X-ray diffraction method were used. For the comparison, weighted scoring system was worked out, and the coating systems were classified into 3 categories (good, medium and inadequate).

EIS and gravimetric study of coatings from water-borne coatings

by G. Győri-Lendvay, T. Pajkossy and B. Lengyel

Two statements were found on corrosion protection properties of coatings from water-borne paints. The first is about the physically and the second one is about the physically and oxidative way becoming dry coatings.

1. According to the EIS studies the applied wet-dry cycling resulted significant improvement by physically dried paints on basis of styrole-acrylate systems, what was interpreted with the lost of water dissolved components. The statement stays in agreement with melioration in time of coatings used in outdoor.
2. On the basis of gravimetric studies can be stated that the two types of resin films are able to take up more water. The inclusion of water is slow the giving down is faster. The phenomenon is interpreted by swelling of resin with water and so hinders the further water inclusion in deeper layers. By drying the swelled resin particles lose water at first on the air/resin boundaries, making way for the water to leave the deeper layers. So by outdoor utilization

(wet-dry cycling) on the paint/metal boundary is more difficult to reach for the humidity. Therefore the corrosion is less probable. This is the reason that in spite of the fact of much humidity uptake these coatings make surprising good corrosion protecting activity by outdoor use in wet-dry conditions.

Devices and practice of cathodic protection

by M. Horvátth

The article systematizes the cathodic protection knowledge from the point of view of technical designers and contractors. It takes practical and standardized criterions of cathodic protection and the steps of the planning one after the other. Deals with building units of cathodic protection system (cathodic protection stations, anodes, reference electrodes, connections and cables) one by one.

Reconstruction of cathodic protection on product and oil pipelines of MOL Inc. in the years 2003–2006

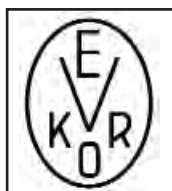
by Zs. Moldován and M. Tompa

The length of product and oil pipelines of MOL Inc. is more than 2000 km. The significant length of pipe is running along with gas and other pipelines. The most of the sections are 60 years old, the intersection of works is "electrolyte short-circuited" and the insulation of pipes are insufficient. Thus the corrosion protection of the pipelines is disadvantageous. There is cathodic protection in the pipes from the beginning of the operation, and for the advantageous operation of transportation reconstruction of cathodic protection system is needed. Also modern GPS and GSM system based remote control method integration is required.

Licensing procedure for paints valid after joining to EU

by V. Zanathy

The author has studied nowadays valid regulations for issuing and using coatings in Hungary. It has been stated that ÉME license is needed, and only two organizations are authorized to issue this license.



KORRÓZIÓS TUDOMÁNY

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SYNOPSIS OF THE PAPERS IN THIS ISSUE***Uranium accumulation on austenitic stainless steel surfaces***

by P. Dombóvári, P. Kádár, T. Kovács, K. Radó, I. Varga, K. Varga, P. Halmos, J. Borszéki, J. Kónya, N. M. Nagy, L. Kövér, D. Varga, I. Cserny, J. Tóth, L. Fodor, A. Horváth, T. Pintér and J. Schunk

As a result of the breakdown on April 10, 2003 there was a significant uranium contamination in some technological units of the reactor block 2 of the Paks Nuclear Power Plant (PNPP). The fact is that the uranium nuclides can present in different chemical forms in the boric acid coolant, and the limited pieces of information about the uranium accumulated on the surface enhance the complexity of the problem.

To clarify issues above it was necessary to carry out a series of comprehensive studies which allows us to get information about uranium accumulation of the primary cooling circuit. In this talk, we give a brief summary of the uranium chemistry, and discuss some experimental findings of U-accumulation obtained in a semi-plant model system. In the present project, we have worked out an alpha-spectrometric detection procedure which is suitable for the measurement of the activity-concentrations of both liquid- and surface-phase uranium. In addition, we have analyzed the oxidation state of uranium by XPS (X-ray Photoelectron Spectroscopic) method. Maximum of uranium-sorption was measured at $\text{pH} = 6$; the maximum surface excess approaches to a monolayer coverage (assuming sorption of $(\text{UO}_2(\text{OH})_2)$).

Planned corrosion protection of new M0 Budapest ring north motorway bridge

by Mrs. J. Sztrakay and V. Zanathy

Nemzeti Autópálya Zrt. is employed in developing freeway network of road traffic. An about 2 km long Danube bridge has been planned to the north sector of M0 Budapest Ring. From the point of view of life-time and maintenance cost, corrosion protection of steel bridges is significant. The article deals with the planned corrosion protection of this bridge.

Contributions to study of degradations by corrosion due to stray currents of concrete steel structures

by J. Lingvay, C. Lingvay,
J. Kovács-Bálan and S. Gombos

With the aim to study the degradation mechanisms of concrete steel structures under the influence of stray currents, we have determined, on cylindrical samples, the evolution in time of electrical resistivity, breakage resistance, chemical composition and the pH of concrete too. The determinations were realized comparatively on control samples and samples affected by the constraint of A. C. and D. C. polarization currents in 1% NaCl solution.

Periodic table of the elements

by P. Hencsei

This sort general work tells the story of Dmitriy Ivanovics Mengyelejev and the formation of the periodic table of the elements. Also tales about discovering, naming and marking of the various elements.