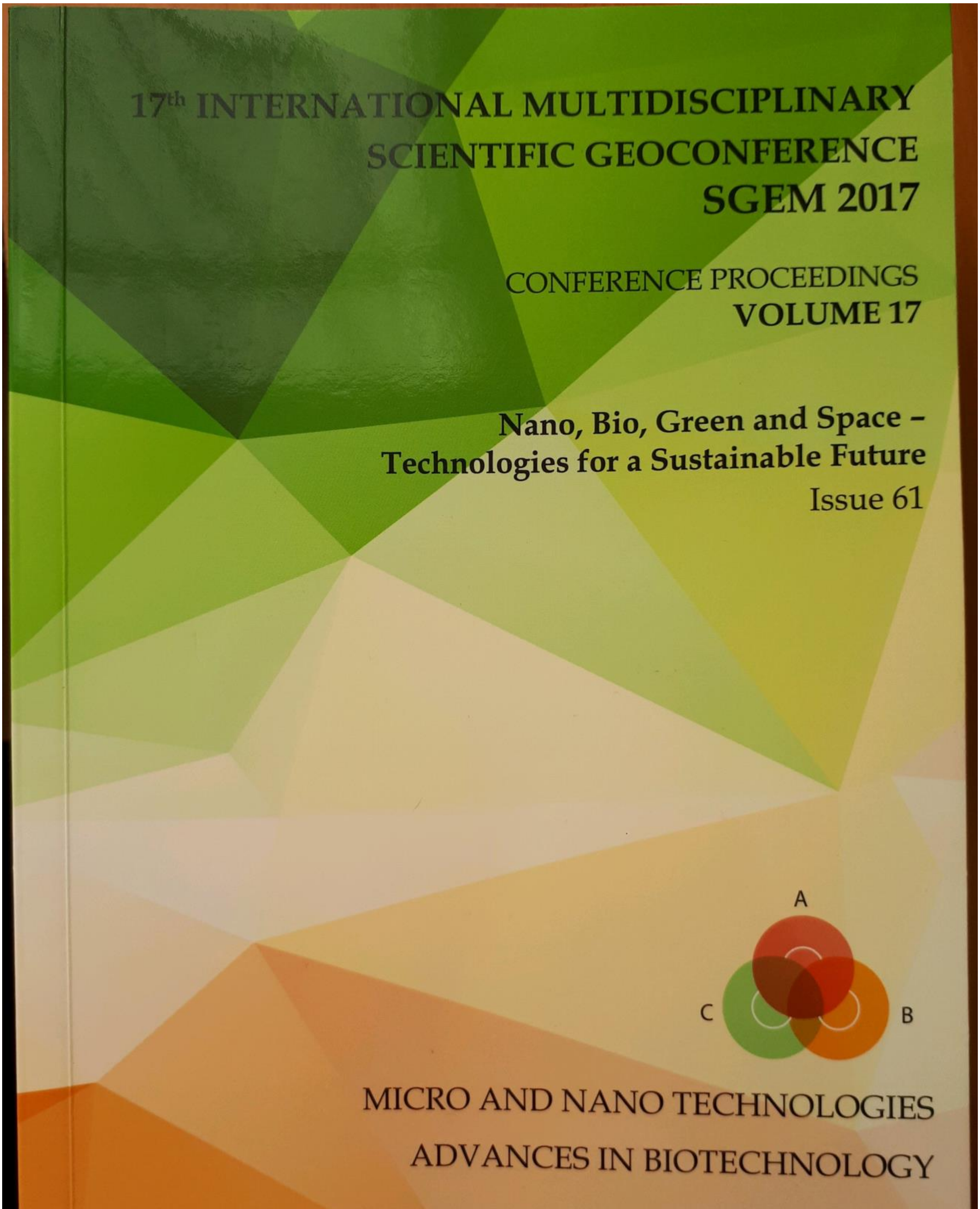

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MICRO AND NANO TECHNOLOGIES
ADVANCES IN BIOTECHNOLOGY

MODERN STATE OF COMPOSITE COATINGS FORMATION PROBLEM

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ABSTRACT

Engineering novel material structures has continually been pursued to further advance modern technologies. These advancements often rely on novel processing technologies. Although many processing parameters have been thoroughly examined in the field of composition coatings, the formation processes are an exception. In this work, we examine the unique microstructures of composite electrolytic coatings, obtaining from electrolytes-suspension which contains nano-size particles of SiO_2 and carbon. Metallographic researches were carried out for an establishing the reasons of essentially differences in corrosion resistance of nano- nano-composition electrolytic coatings received at various electroplating temperatures. The results of corrosion investigation show, that the best corrosion resistance has nano-composition electrolytic coatings received at 333 K temperature. This novel electro-deposition technology has the potential to open new areas of research such as obtaining materials with desired functional properties.

Keywords: coatings, composite, nanosize particles, microstructure

INTRODUCTION

One of modern material science priorities is studying of nano-structured composite electrolytic coatings (nano-CEC) protection properties. This is due to interest in fundamental problems of a multi-component systems and breadth of their application in various fields of engineering, and technology. Therefore, development of new physical processes of composite systems formation and studying mechanical features changing - one of the main problems in materials science [1-5].

The associate to grow shortage of material resources development metallurgy in the world on XXI century it was directed for effectively to use metals and economical alloying , as well as partly taken on ferrous basis – alloys of steel and cast-iron. The requirement to construction to materials, to the objects doing of machine, use to give qualities on a metallurgy it is founded for use thermally, chemical-thermally technology and settled on makes by sources energy for surface of object. It was result such the influence is structurally change first conscience object and this is identified variety process or equal to the becloud surface [6-12]. The level of the research potential, as a whole level to civilization – this is defines claiming new material.

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perspective ideas [
The research progress and development levels incre
materials. Composite electrolytic pillowcases plays m
problem. Composite electrolytic pillowcases- that in wh
metal and in which there is dispersion phase. If dispersi
nm, then they fall into row is nano materials and particl
change characteristic of the matrix of the metal. So n
pillowcase adjusts in separate group, but main nano comp
and main exploratory work elaborates their character
characteristic CM not always requires full volume concer
determined stage to becloud it is enough. The method n
pillowcase (nano-CEP) give possibility together mix disp
electrolytic [20-23].
In our the country method of study determination micro h
years known. Method determination micro hardness met
PMT-3 thought up famous scientist M.M.Hrushcev a
Basically equipment PMT-3 is intended for determinatio
microscopic measurement. Presently in enterprise this
technological operation to conversion of the processes of th
them chemical, mechanical layer, as well as for determina
different particles thickness below 0.1 mm.

MATERIALS AND METHODS

The purpose of our researches is developing Cr-SiO_2
coatings obtaining. For the deposition of nano-structu
coatings and we chose the versatile chrome electrolyte c
Composition of electrolytes for nano-CEC precipitation is pr

Table 1. Composition of Cr-SiO_2 electrolyte

Name or formula	Units
Chromic anhydride CrO_3	g/l
H_2SO_4	g/l
Dioxide of silica SiO_2	g/l
Modes of obtaining:	
Electrodepositing temperature T	K
Current density	A/m^2

accuracy

RESULTS AND DISCUSSION

As is known, during mutual contact of solids, the formation of fil
structures occurs in surface layers in the course of friction. At present
formed by the introduction of various admixtures into lubricants, speci
treatment in solid, liquid, or gaseous media, as well as by electrol
solutions of metal salts. Our aim is to develop a method of creation of
precipitation of electrolytic composite coatings. To realize this i
electrolytic composite coatings, based on chromium with disperse pa
and silicon dioxide, on specimens made of St3 steel. We achieved t
modifying layer in the course of friction by tests of electrolytic compo
friction machine coupled with a counterbody made of hardened Sh
carried out tests without lubricants. Under such severe conditions,
occur in the near-surface layers of bodies rubbing each other, i
components of electrolytic composite coatings but elements of the
part. We subjected a modified film formed during this procedure
optic and electronic examinations and to electron diffraction investiga
The results of metallographic examinations demonstrate that, at t
electrolytic composite coatings, disperse particles of silicon diox
distributed quasi-uniformly in the coating volume. Therefore, v
assume that disperse particles will come uniformly from the coati
contact zone in the course of tests of electrolytic composite coating
It is worth noting that disperse particles mostly enter the contact zo
parts as they gradually leave the metal matrix and are robbed
contact surface. In this case, all possible physicochemic
simultaneously, which results in the formation of a modifying la
structure representing a metastable phase, on which the main actio
course of friction and wear. Just this phase was the object of our i
Electron diffraction investigations show that almost half
diffractograms cannot be identified with those from any known e
of chromium, sulfur, silicon, and oxygen. This testifies to the f
amount of phases appearing during friction and wear
nonstoichiometric, and very complex by their composition. Thes
specific character and complexity of physicochemical processes
contact friction surface.

The structural adapta same specimen at various stag
diffractograms taken from the same specimen at various stag
length is about 500 m. After every stage of the frictio
diffractograms of all Nnds of specimens. We have establishe
tests, the process of friction and wear only begins at sections
the diffractograms consist of individual reflections. At the se
further developing, and the diffractograms consist of conti
circles. After the third stage of tests, the number of diffra
reflections gradually diminishes, the number of diffractogram
decreases, and the number of diffractograms with vague ring
the fourth stage of tests, all the diffractograms consist of
stage corresponds to minimum wear and maximum struct
modifying layer.

By comparing modifying layers obtained upon the introductio
with similar layers appearing on the surface of electrolyti
should mention the following obvious advantages of the latte
Disperse particles, introduced into oil as an admixture, can e
together with oil. But, for electrolytic composite coatings,
from within the coating as a result of wear or deformation
action of external loads. The less the coupled parts fit eac
load), the greater is the amount of an admixture coming into th
With use of data of Table 2 and results of the chemical anal
06XN28MDT [5] In chloride-containing solution with pH
vibrated from 0.17 melt 1 to 1.04 melt 4. It was known th
quantity on surface of alloy is larger than in its volume. Thu
06XH28MDT Cr quantity on surface of the samples incr
chloride-containing solution with pH7 and concentration of
decrease of pH chloride-containing solution to 6 a value of
(melt 5) to 1.48 (melt 3). In this case Zc_r melts 1 didn't cha
decreased(Table 2). However, such tendency has been
determination error of Cr in solution after endurance of sar
consider that in decrease of pH chloride-containing solu

№ pH	Z_{Cr}	Z_{Ni}	Z_{Cr}	Z_{Ni}					
6	0,17	0,54	0,17	0,83	1,48	1,95	1,28	0,69	0,61
7	0,17	1,33	0,22	1,09	0,23	0,84	1,04	0,80	0,44

$\Delta Cr = 10^{-6} (-1044,43+5000Mn);$ $r= 0,72$

$\Delta Cr = 10^{-6} (-3589,92+5000Si);$ $r= 0,87$

$\Delta Cr = 10^{-6} (-262,52+50000d_3);$ $r= 0,72$

$\Delta Cr = 10^{-6} (9840,20-3333Mo);$ $r= -0,71$

In addition, it has been established by graphical analysis that a content
Ni, P, volume of titanium nitrides V_H, volume of oxysulfides V_{0K}, and als
distance between titanium nitrides L_H and oxysulfides L_{0K} ambiguously inf
corrosion losses of Cr frod alloy in chloride-containing solution with
concentration of chlorides 600 mg/1.

In particular, between ΔCr and parameters of alloy the parabolic depen
between ΔCr and V_{0K}, LOK - hyperbolic has been established. In increase
distance between inclusions their sizes grow. Therefore it follows from data
that ΔCr is decreased in increase of sizes of titanium nitrides to average
subsequent increase of sizes of titanium nitrides favors growth of ΔCr of al
into account such tendency and data of Table 2. e, one can assume that titan
of average sizes cathodally protect an alloy 06XN28MDT in the investigat
containing solution and thus, decrease the corrosion losses of Cr. At the bo
titanium nitrides with austenite matrix the dissolution of Cr from alloy is int

CONCLUSIONS

The introduction of modified electrolytic composite coatings at a cable pl
that they give the possibility:

- to increase the service life of draft tires by up to 20 times as c
commercial ones made of deficient and expensive ShKhl5 steel;

alloy [illegible]
with pH=6; 7 and concentration of chlorides 600 mg/l ha
-in chloride-containing solution with pH=6 the corrosi
regularity grow in increase of content C, P in alloy, ave
nitrides and decrease of Mn, and also volume of titaniun
large oxysulfides and titanium nitrides Ni from alloy is i
oxysulfides, titanium nitrides and complex carbides a
dissolution of Ni, and P as a surface-active element inten

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