

РЕЗЮМЕТА НА НАУЧНИТЕ ТРУДОВЕ **на доц. д-р Здравка Кирилова Карагъзова**

представена за участие в конкурс за заемане на академичната длъжност професор, обявен в ДВ бр.12 от дата 06.02.2018г. от Института за космически изследвания и технологии-БАН в област на висше образование 5. Технически науки; професионално направление 5.6. Материали и материалознание, научна специалност „Динамика, якост и надеждност на машините, уредите, апаратите и системите (нанотехнологии и материали за приложение за космически изследвания)“, за нуждите на секция „Космическо материалознание“

I. РЕЗЮМЕТА НА ПУБЛИКАЦИИ, РАВНОСТОЙНИ НА МОНОГРАФИЧЕН ТРУД

- 1. *S.Stavrev*, Z.Karaguiozova, FORMATION OF NICKEL LAYERCOVERS ON NANODIAMOND POWDER, issue 7 ,edited by E. Balabanova, I. Dragieva, Heron press science series 2007, 219-221 ISBN 978 954-580-228-7***

Abstract: The paper has studied electroless method with reducing agents hypophosphite ions for deposition of Nickel coatings on nano diamond (UDDP) and micro diamond powders. The analysed nano diamond is produced by detonation method. The possibilities for yielding the composites with coated diamond powder are investigated. Some mechanical properties of the composites have been tested. The obtained thin metal film on the grains enables better impregnation into the matrix, extending MMC life.

- 2. *Zdravka Karaguiozova, Julieta Kaleicheva, Valentin Mishev, Milko Yordanov, ELECTROLESS NICKEL COATINGS WITH MICRO AND NANO ADDITIVES, Nanoscience & Nanotechnology, 17, 2, 2017, pp. 28-32 ISSN 1313-8995***

Abstract: The present work is focused on the investigation of the physical and mechanical properties of composite nickel coatings with strengthening micro and nano sized additives. Microsized cBN and nano sized diamond (DND) particles are used. Electroless method EFTTOM-NICKEL is applied for development of an innovative technology for production of composite coatings Nickel- cBN and Nickel - DND. Metallographic observations are performed for the coatings' thickness measurement. Wearing of tests of the as-plated coatings, also of the thermal treated coatings at 290C for 6h are carried out. Nano indentation test method is used for measurement of the coatings' hardness and elasticity. The influence of the thermal treatment of the obtained coatings of the above mentioned properties is examined.

- 3. *Julieta Kaleicheva*, Zdravka Karaguiozova†, Valentin Mishev*, Enhancement of surface properties of steel samples using new technique for electroless nickel plating, FDIBA Proceedings of the Conference “The Digital Transformation:***

Challenges in Technological, Scientific and Social Development”, 30 November – 1 December 2017, International Visitors Center “Helmuth Böhme”, Technical University of Sofia, Bulgaria – scopus, pp. 97-100 ISSN 2535-132X(Print); ISSN 2535-1338 (online)

Abstract: This study is focused on the possibilities for material surface properties enhancement by electroless nickel plating method. Substrates of steel 17CrNiMo6 are used for the manufacture of the specimens. Electroless method EFTTOM-NICKEL is applied for the development of an innovative technology for production of as plated nickel and composite Nickel coatings. Detonation nano diamond particles (ND) are used as a strengthening material for production of composite nickel coatings. Suspension of ND is added directly to the electroless bath using a suitable surfactant achieve well dispersed particles in the bath and to facilitate their embodiment and equal distribution in the coating. The influence of nano diamond particles on the coatings mechanical and physical properties is confirmed by the results achieved carrying out as morphology and microstructure observation by optical metallography and scanning electron microscopy (SEM) and also wear and nano indentation tests. The influence of the thermal treatment of the obtained coatings on the above mentioned properties is examined.

4. Kaleicheva J.K., Karaguiiozova Z., Improvement of the Wear Resiatance of Ferrous Alloys by Electroless Plating of Nickel, IOP Conference Series: Materials Science and Engineering (MSE) doi:10.1088/1757-899X/295/1/012036

Abstract: The electroless nickel (Ni) and composite nickel – nanodiamond (Ni+DND) coatings are investigated in this study. The method EFTTOM-NICKEL for electroless nickel plating with nanosized strengthening particles (DND 4-6 nm) is applied for the coating deposition. The coatings are deposited on ferrous alloys samples. The wear resistance of the coatings is performed by friction wear tests under 50-400 MPa loading conditions – in accordance with a Polish Standard PN-83/H-04302. The microstructure observations are made by optic metallographic microscope GX41 OLIMPUS and the microhardness is determined by Vickers Method. Tests for wear resistance, thickness and microhardness measurements of the coatings without heat treatment and heat treatment are performed. The heat treatment regime is investigated with the aim to optimise the thermal process control of the coated samples without excessive tempering of the substrate material. The surface fatigue failure is determined by contact fatigue test with the purpose to establish suitable conditions for production of high performance materials.

5. KALEICHEVA Julieta Atanasova, KARAGUIIOZOVA Zdravka Kirilova, Electroless Composite Nickel Coatings Strengthening with TiN Nanoparticles Plated on Ductile Cast Iron, Special Volume Issue: “Novel Trends in Production Devices and Systems IV”, Slovak University of Technology in Bratislava. Faculty of Materials Science and Technology in Trnava, Slovak Republic, Materials Science Forum , ISSN 1662-9752– scopus SJR, pp.52-58

Abstract: Electroless nickel (Ni) and composite nickel coatings (Ni+TiN) are investigated in this study. EFTTOM-NICKEL Method for electroless nickel plating is applied. Nanosized TiN particles (50nm) are used as a strengthening material. The coatings are plated on ductile cast iron samples. The wear test of the coatings by the classic model TABER-ABRASER “disc to disc” are carried out. The observation of the samples’ microstructure by means of an optical metallographic microscope GX41 OLYMPUS and the microhardness measurements by Knoop Method are performed. The wear resistance, the hardness and micro hardness of the samples before and after thermal processing at 290 C, 6 hours are defined.

6. Zdravka Karaguiozova, Characterisation of electroless Ni-P and electroless composite coatings Ni-P/Ni-PTFE, IJSurfSE – submitted , ISSN online: 1749-7868; ISSN print: 1749-785X

Abstract: The present study is based on the investigation and characterisation of electroless nickel (Ni-P) and composite nickel – PTFE (Ni-P/Ni-PTFE) coatings. The plating bath composition and the technological regime for production of electroless nickel coatings are proposed. An easily controlled, ecofriendly and simple in operating system technology is developed applying electroless method EFTTOM-NICKEL. PTFE particles are added to the plating bath in suspension. The investigation on the possibility to obtain a stable PTFE suspension is implemented. One layer Ni-P coatings and double layer Ni-P/Ni- PTFE coatings are plated on steel samples. The volume of incorporation of PTFE is measured depending on the temperature, pH, etc. Microhardness, wear resistance tests and dynamic friction coefficient are measured and comparison the results are performed for Ni-P and Ni-P/Ni-PTFE coatings with different vol. % of incorporation of the PTFE particles.

7. Valentin Mishev, Julieta Kaleicheva, Zdravka Karaguiozova, Georgy Avdeev, Structure and properties of austempered cast irons with nanoadditives, Nanoscience & Nanotechnology, 17, 2, 2017, pp. 7-10, ISSN 1313-8995

Abstract: The microstructure and mechanical properties of austempered ductile irons (ADI) having structure of lower and upper bainite with additives of titanium nitride and titanium carbonitride (TiN+TiCN) are investigated. For improvement of the particles wetting and distribution into the melt volume the electroless method for plating of the additives is applied using EFTTOM-NICKEL method. The microstructure of the patterns is observed by optical metallography, X-Ray analysis, SEM and EDX analysis. Test for hardness is carried out. The influence of the nanosized particles on the graphite phase modification is proved. The effects of the nanosized particles on the bainitic phase transformation and on the morphology of the lower and upper bainitic structure is studied.

8. J. Kaleicheva, V. Mishev, Z. Karaguiozova, G. Nikolcheva, A. Miteva, Effect of Nanoadditives on the Wear Behavior of Spheroidal Graphite Cast Irons, Tribology in Industry, 39, 3, 2017, 294-301, ISSN: 0354-8996 (print); 2217-7965 (online), 2016 SJR=0.463; Scopus CiteScore™ 2016: 1.32

Abstract: The tribological characteristics of spheroidal graphite cast irons with and without nanosized additives are investigated. The tests are performed as in cast iron condition as well after austempering. The spheroidal graphite irons are undergone to austempering in the bainite field, including heating at 900 °C for an hour, after that isothermal retention at 280 °C, 2 h and at 380 °C, 2 h. The lower bainitic and upper bainitic structures are formed during the process. Nanosized additives of titanium carbonitride and titanium nitride TiCN+TiN influence on the graphite phase characteristics and on the microstructure of the cast and austempered spheroidal graphite irons. The changes in the micro structure the irons with nanoadditives lead to an abrasive wear resistance increase. The formation of the strain induced martensite from the retained austenite in the friction contact area during wear is determined in the austempered irons. This is the reason for the wear resistance increase of the irons. The experimental testing of the wear is carried out by cinematic scheme tapper-disc under friction on the fixed abrasive. The microstructure of the patterns is observed by optical and quantitative metallography, X-Ray analysis, SEM and EDX analysis. The hardness testing is performed by Brinnel and Vickers methods.

9. Julieta Kaleicheva, Valentin Mishev, Zdravka Karaguiozova, Galina Nikolcheva, Structure and Mechanical Properties of Spheroidal Graphite Cast Iron with Nanosized Additives, Environment. Technology. Resources. Proceedings of the 11th International Scientific and Practical Conference. Volume 3, June 15-17, 2017, Rezekne Academy of Technologies, Rezekne, Latvia, pp. 122-128, ISSN 1691-5402 - scopus

Abstract: The microstructure and properties of spheroidal graphite cast irons and austempered ductile irons with nanosized additives of titanium carbonitride and titanium nitride (TiCN+TiN), titanium nitride TiN and cubic boron nitride cBN are investigated. The microstructure of the patterns is observed by optical metallography, quantity metallographic analysis, X-Ray analysis, SEM analysis and EDX analysis. Hardness measurement, impact strength and abrasion wear test on fixed abrasive are performed. The influence of the nanosized additives on the microstructure, mechanical and tribological properties of the cast irons are examined.

10. Julieta Kaleicheva*, Valentin Mishev*, Zdravka Karaguiozova†, Effect of Nanoadditives on the Characteristics of Bainitic Transformation in Spheroidal Graphite Cast Irons, FDIBA Conference “The Digital Transformation: Challenges in Technological, Scientific and Social Development”, 30 November – 1 December 2017, International Visitors Center “Helmuth Böhme”, Technical University of Sofia, Bulgaria – scopus, pp. 113-116 ISSN 2535-132X(Print); ISSN 2535-1338 (online)

Abstract: In the present study austempered ductile cast irons (ADI) with upper bainitic structure are investigated. Nanosized particles (50nm) of titanium carbonitride-titanium nitride (TiCN-TiN), titanium nitride (TiN) and cubic boron nitride cBN are added to the casting volume. The samples microstructure is studied by means of optical metallography, scanning electron microscopy and X-Ray analysis. The influence of the nanosized additives

on the kinetic of the bainitic transformation and on the morphology of the bainitic structure is investigated. The abrasive wear testing , hardness measurements and impact strength are carried out. It is established that the presence of nano additives in the bainitic irons leads to the changes in their microstructure which increases their mechanical characteristics and abrasive wear resistance. The studied nano composite materials expand the potential for new ADI applications in the industry.

II. РЕЗЮМЕТА НА ПУБЛИКАЦИИ, ИЗВЪН РАВНОСТОЙНИТЕ НА МОНОГРАФИЧЕН ТРУД

11. Хр.Василев, Л.Карагъзов, З.Карагъзова, Д.Кунев, Екстракция на рений от молибденсъдържащи разтвори, Сп. Металургия 9, София, 1977, ISSN: 0543-5038

Резюме: В представеното изследване е предложен усъвършенстван метод за извличане на рений от прахове, получени при пържене на молибденови концентрати. В резултат на обработката на тези прахове реният се извлича чрез екстракция и се отделя електролизно, при което се получава висока степен на онечистване на материала с молибден. Предложеният усъвършенстван метод позволява да се създадат условия за по-пълно насищане на екстрагента с рений, при което екстрахируваният молибден да бъде изместен и да се повиши ефективността на екстракционното извличане на рений. Като екстрагент е използван 1,5% Аликват 336, а след реекстракцията на рений с HClO_4 , екстрагентът се регенерира с $2n \text{HNO}_3$. Получават се и важни в технологично отношение резултати, именно: намалява се броят на екстракционните степени, също и концентрацията на екстрагента. Полученият рениев разтвор е с висока чистота, подходящ за електролизно отделяне на рений в чист вид.

12. G.Georgiev, Z. Karagyozova, B.Kozov, Tin-plating of Printed Circuits, Конференция Химически продукти за електрониката, 19-21.11.1981

Резюме: Предложен е разтвор за безтоково покаляване на мед. Изследвано е влиянието на технологични параметри на процеса (време на отлагане, температура на разтвора, продължителност на натоварване на разтвора) и на състава на работната вана върху структурата и спойваемостта на получените покрития и върху дебелината им. Предложено е използването на добавки от двувалентни метални йони, ПАВ и редуциращи съединения към разтвора за покаляване и е проследено влиянието им върху характеристиките на покритието. Установен е състав на разтвора за покаляване, позволяващ получаване на ситнозърнести, добре спойваеми, корозионно устойчиви покрития.

13. Г.Георгиев, З.Карагъзова, Новый метод разъедания меди и медных сплавов, International Symposium Technologies and equipment for corrosion protection by metallic and nonmetallic coatings, 138 Event of the European Federation of Corrosion, Albena, Varna, Bulgaria 5-7.06. 1986, pp.134-139

Резюме: Представеното изследване цели разработване на технология за ецване на мед и медни сплави с разтвор на основата на H_2SO_4/H_2O_2 . Проследено е влиянието на температурата на работния разтвор и на съдържанието на молибденови йони върху скоростта на ецване и на разпадане на водороден прекис. Определени са оптималните условия за работа, при които се запазва постоянна скорост при непрекъснатост на работния процес. Предложени са добавки за съставяне и коригиране на работни разтвори за ецване на мед и медни сплави.

14. G.Georgiev, Z.Karagiozova, *Stromlosses Verzinnen von Kupfer und Kupferlegierungen, Proceedings Corrosion Week, lectures II, 610, Budapest, 1988, 610-615, ISBN 10 9638093308*

Резюме: Разработен е разтвор за обменно покаляване на мед и медни сплави с перспектива за приложение в производството на печатни платки. Изследвано е влиянието на добавка от двувалентни метални йони (Mn, Cd, Ni, Co), на редуктор (NaH_2PO_2) и на ПАВ към работната вана върху спойваемостта на получените покрития. Установено е влиянието на продължителността на процеса върху дебелината на покритията при различни работни температури. Изследвана е структурата на покритията, получени от разтвор без добавки, от разтвор с добавка на ПАВ и на двувалентни йони на Co и Mn. Установено е благоприятно влияние на последните върху изситняването на структурата на покритията.

15. S. Stavrev, J. Karadjov, L. Markov, A. Petrova, Z. Karagyozova, *The "Osnet" No GTC1-2000-2820, Project of the fifth Framework Programme, Nanoscience and Nanotechnology, 2001, pp. 137-138 ISBN 954-580-097-6*

Abstract: The "OSNET" project is the "Development" Programme which has key activities "Innovation product, processes and organisation". In itself it's a network and covers all important branches of output, working up and utilisation of the decorative stones, equipment, environment and safety.

The provided products can be used in wide range of key area e.q. as diamond instruments, machines, equipment, etc.

16. D. Mitev, S. Stavrev, J. Karadjov, L. Markov, Z. Karagyozova, *Contemporary state and perspectives of production and application of nanodiamond powders in Bulgaria, Collection of materials – International Conference "Blasting Techniques and Technology" (journal "Explosive"), Varna, Bulgaria, 2005*

Резюме: Разгледани са основни технологични моменти при производството на наноразмерни диамантени прахове-детонационен синтез, осъществявано в секция „Космическо материалознание и нанотехнологии“ при ИКИ-БАН. Изложени са характеристики на рафинираните прахове и на изходните взривни шихти. Дадени са примери за употребата на нанодиаманти в композитни електролитни покрития на база никел с високи експлоатационни свойства; като добавки в

автомобилни масла, гуми и бои; компоненти в режещите елементи на скалодобивни машини и др.

Показани са перспективите пред нанодиамантеното производство на българска територия, и в контекста на Европейския съюз-през призмата на европейските научни програми, в които секция „КМН“ при ИКИ-БАН е страна.

17. Петрова А., С. Ставрев, З. Карагьозова, Состояние синтеза в България, перспективните технологии и их приложение, 28-30.09.2009г, МИСиС, Москва, стр. 17-21, ISBN 9785-87623-280-9

Abstract: В предлагаемой работе сделан анализ развития синтез наноструктур в Болгарии вообще и детонационный синтез кубических наноструктур в частности. Определены причины и условия, позволяющие развивать данные методы синтеза наноструктур в БАН и ИКИ-БАН. Подчеркнуты созданные и поддерживаемые узкие связи с институтами РАН и рядом университетов, как основ для развития данного направления в Болгарии.

18. Dimitar BUCHKOV, Julieta KALEICHEVA, Zdravka KARAGUIOZOVA, Viktor ANTCHEV, Stavri STAVREV, THE SURFACE PROPERTIES IMPROVEMENT OF IRON ALLOYS BY ELECTROLESS COMPOSITE NICKEL COATINGS, PROCEEDINGS of the 28-th International Scientific Conference of the Faculty of Industrial Technology of TU-Sofia, “ 70 years FIT”, FIT`2015, pp.189-195, ISBN: 978-619-167-178-6

Abstract: The possibilities for plating of composite coatings on iron alloys (steel 17CrNiMo6 and spheroidal graphite cast irons) are investigated. The refined EFTTOM-NICKEL Method for electroless plating is used. The detonation nanodiamond (ND) is used as strengthening particles to be involved into the composite. The layers microstructure and their phase composition are investigated by metallic graphic and X-Ray analysis. The micro hardness testing by Knoop Method and wear resistance examination are performed. The composite coatings with improved properties are produced.

19. J. Kaleicheva, V. Mishev, R. Lasarova, Z. Karaguiozova, STUDY OF SPHEROIDAL GRAPHITE CAST IRON WITH NANOSIZED ADDITIVES, Nanoscience & Nanotechnology, 15, No 1, eds. E. Balabanova, E. Mileva, Sofia, 2015, 40-43, ISSN: 1313-8995

Abstract: Two spheroidal graphite cast iron compositions with nanosized additives – titanium nitride+titanium carbonitride (TiN + TiCN), titanium nitride TiN and cubic boron nitride cBN are studied. The cast iron structure is observed by optical and quantitative metallographic analysis. The graphite sphere size, the graphite, ferrite and pearlite quantity are determined. The Brinell's hardness, impact toughness and wear tests are performed. The nanosized additives influence the graphite morphology, cast iron microstructure and physical and mechanical properties are investigated.

20. Zdravka Karaguiozova, ELECTROLESS DEPOSITION OF METALIC COATINGS ON MAGNESIUM ALLOYS, Proceedings of Eleventh Scientific Conference with International Participation SES 2015, "Space Ecology Safety", 376-382 ISSN 1313 - 3888

Abstract: Magnesium is the subject of interest from scientists due to his lightness combined with strength. Magnesium density is only two thirds of the aluminium's. This is a reason magnesium and its alloys to be widely applicable in areas of the industry as aircraft production, automotive and missile construction. This leads to fuel economy and reduced weight.

A big problem for the magnesium and its alloys utilising is its high chemical activity, which generates corrosion of the surfaces. To achieve optimum results in term of corrosion and wear protection of magnesium alloys a proper electroless and electrochemical coating deposition technique could be used.

The complicated behavior of the magnesium and its alloys during plating or chemical treatment processes requires the use of a specific pretreatment leading to equipotential material surface the technically and economically viable coating systems to be produced.

21. Zdravka Karaguiozova, Petrova A., Aleksander Ciski, Grzegorz Cieślak DISPLACEMENT (IMMERSION) TIN PLATING, Proceedings of Eleventh Scientific Conference with International Participation SES 2015, "Space Ecology Safety", 383-388 ISSN 1313 - 3888

Abstract: The metal layering on the metal surface flowing without the presence of the reducing agents or an external source of electricity is called immersion plating. The salt solution of the noble metal and less noble metal substrate are needed the process to take place. The deposition of the noble metal on the plated surface is observed due to displacement process.

The immersion plating of Tin on Copper is too popular in the production of printed circuit boards. The displacement of copper with tin in the solution of tin salt becomes. The achieved layer is characterised with better solder wettability, corrosion and oxidation protection of the surface.

The morphology observation, hardness and elasticity measurements are carried out of the Tin and Tin- DND coatings.

22. Zdravka Karaguiozova, Adelina Miteva, Aleksander Ciski, Grzegorz Cieślak, ABOUT SOME COATINGS FOR AEROSPACE APPLICATIONS, Proceedings of Eleventh Scientific Conference with International Participation SES 2015, "Space Ecology Safety", 389-396 ISSN 1313 - 3888

Abstract: This study is focused on some coatings used in aerospace area. The special inherent properties of many metals and their alloys have focused attention on their increasing application in aerospace and allied industries. However, severe operating conditions in air and space often limit the possibility of using these alloys directly. Therefore to reduce the influence of adverse environmental space conditions and for successful use in aerospace industry these metals and their alloys require special surface preparation, namely deposition

of different types of coatings on their surfaces. In this paper we will briefly present several types of the most aerospace applicable coatings.

- 23. Zdravka Karaguiozova, Adelina Miteva , Aleksander Ciski, Grzegorz Cieślak, MAGNESIUM APPLICATION IN AEROSPACE INDUSTRY, Proceedings of Eleven Scientific Conference with International Participation SES 2016, "Space Ecology Safety", 2017, 385-390 ISSN 1313 - 3888**

Abstract: At present magnesium and magnesium alloys are the subject of growing interest from scientists mainly due to his lightness combined with strength. This is the main reason magnesium and its alloys to be widely applicable in areas of the industries such as aerospace and aircraft production, automotive and missile construction, electronic, projectiles, powertrain and army applications. Application of magnesium and magnesium alloys leads to reduced weight, and consequently to fuel economy, and consequently decreasing the output of environmentally harmful substances. In this literature review we will briefly focused the attention on increasing applications of magnesium and magnesium alloys in aerospace and allied industries.

- 24. Zdravka Karaguiozova, HYDROGEN PEROXIDE/SULPHURIC ACID ETCHING SOLUTION, Proceedings of Eleven Scientific Conference with International Participation SES 2016, "Space Ecology Safety", 2017, 391-396.ISSN 1313 - 3888**

Abstract: Copper dissolution known also as a copper etching is a process essential in the electronics industry, particularly in the fabrication of printed circuit board. Recently the focus of the researchers is on the system ensures high etch rate at a lower consumption of the solution components. In this study, a copper etchant on the base of H_2SO_4/H_2O_2 solution is used and the influence of the various effects on the main etching parameters is investigated. The impact of the etching temperature and different chemical additives to main etchant are examined. The chemical additives with a stabilising and accelerating effect are tested. The additives independent impact also their synergetic effect on the H_2O_2 decomposition is studied.

- 25. Z. Karaguiozova, J. Kaleicheva, V. Mishev, G. Nikolcheva, Enhancement in the tribological and mechanical properties of electroless Nickel-nanodiamond coatings plated on iron, Tribology in Industry, 39, 4, 2017, pp.444-451 ISSN: 0354-8996 (print); 2217-7965 (online), SJR=0.463; Scopus CiteScore™ 2016: 1.32**

Abstract: A technology to improve the tribological and mechanical surface properties of iron alloys is developed based on the electroless nickel plating. The technology combines sol-gel and electroless deposition technique. Novel nanocomposite coatings are obtained consisting of Nickel-phosphorus- nanodiamond (Ni-P-ND). The ND sol is added directly to the electroless Ni-P solution. A suitable surfactant is added to achieve well-dispersed ND particles in the electroless solution to facilitate their embodiment and equal distribution in the coating. Substrates of steel 17CrNiMo6 and spheroidal graphite cast irons are used for the

manufacture of the iron alloys specimens. The surface morphology and microstructure observation performed by scanning electron microscopy (SEM) and optical metallography confirms the influence of ND particles on the coating structure. The structural phase investigation by X Ray analysis indicates a transformation of the amorphous phase to a crystalline one such as Ni, Ni₃P after coatings' heat treatment. The microhardness investigation by Knoop Method and wear resistance measurement in accordance with the Polish Standard PN-83/H-04302 of Ni-P and Ni-P-ND composite coatings are evaluated and compared with each other. The increase in the value of hardness and wear resistance of Ni-P composite coatings in the presence of ND particles and after heat treatment is obtained.

26. Zdravka Karaguiozova, Immersion tin coating and process for using as etch resist, International Journal of Materials and Product Technology, Your submission code is IJMPT-189981, ISSN online 1741-5209, ISSN print 0268-1900, IF 0.365 (5-Year Impact Factor: 0.351)

Abstract: The aim of the present study is the development of an easily controlled, ecofriendly and simple in operating system solution, applicable in an etching process in the production of PCB's. The suggested etchant is on the base of Hydrogen Peroxide/Sulphuric Acid system. For the protection of the metallic copper of the tracks and holes from oxidation and to ensure their good solder-ability Tin etch resist is utilised. The etch resist is on the base of immersion Tin plating process. The influence of the Hydrogen Peroxide consumption on the etched surface with addition to the solution of different stabilisers and accelerators also inhibitors of the Tin resist is investigated. The best etchant performance is defined during precise controllability of the process at high environment protection.

27. Karaguiozova, Z., Miteva, A., Ciski, A., Cieřlak, G.. Some aerospace applications of aluminium alloys. Proceedings: Thirteenth International Scientific Conference "SPACE, ECOLOGY, SAFETY", 2 – 4 November 2017, Sofia, Bulgaria, 2017, Space Research and Technology Institute – Bulgarian Academy of Sciences, 2017 pp.327-332, ISSN:1313 3888

Abstract: At present aluminium and its alloys are subject of growing interest from scientists and are widely used in many industries because of their advantages, which are due to their properties.. In this literature review paper we will briefly focus the attention on some of the existing and increasing applications of aluminium and aluminium alloys in aerospace and allied industries. A critical discussion is presented. Possible future extensions of the work in this field are considered.

28. Zdravka Karaguiozova, SILVER COATINGS PLATED BY ELECTROLESS METHOD, Proceedings: Thirteenth International Scientific Conference "SPACE, ECOLOGY, SAFETY", 2 – 4 November 2017, Sofia, Bulgaria, 2017, Space Research and Technology Institute – Bulgarian Academy of Sciences, 2017, pp.333-337 ISSN:1313 3888, 333-337.

Abstract: The immersion silver plating is on the focus of the present work. The ecological technology is established on the base of the developed stable solution, avoiding the use of

cyanide ions. The obtained coatings are uniform, dense with good solder wettability and high corrosion resistance suitable for application in a production of printed circuit boards.

III. РЕЗЮМЕТА НА АВТОРСКИ СВИДЕТЕЛСТВА

29. АС рег. №61642, Г.Георгиев, З.Карагъзова, Електролит за отлагане на сплавно покритие калай-кобалт-83г.

Резюме: Изобретението се отнася до електролит за отлагане на сплавно покритие калай-кобалт със съдържание на кобалт до 1мас.%, което намира приложение в електрониката, напр. като метален резист в производството на печатни платки. Създаден е електролит, който не съдържа флуорни йон, работи с по-висока производителност при запазване на добрите свойства на покритието.

30. АС рег. №66441, Г.Георгиев, З.Карагъзова, Г.Пюскюлев, Метод за приготвяне и контролиране на разтвори за ецване на мед и медни сплави-84г.

Резюме: Изобретението се отнася до метод за приготвяне и коригиране на разтвори за ецване на мед и медни сплави, който е приложим в приборостроенето и електрониката при производството на печатни платки и при химическо фрезование. Разработени са концентрирани разтвори за ецване на мед и медни сплави, който позволяват запазване на висока и постоянна скорост на разяждане, нисък разход на водороден перексид и висока екологичност.

31. АС рег. №69248, Г.Георгиев, З.Карагъзова, Д. Аврамов, Комбинирана добавка към сулфатен електролит за отлагане на калай и сплавите му-85г.

Резюме: Изобретението се отнася до комбинирана добавка към сулфатни електролити за отлагане на калай и сплавите му за приложение в електрониката, приборостроенето, корозионната защита и др. Създадена е комбинирана добавка към сулфатни електролити за отлагане на блестящи калаени покрития, както и на блестящи покрития от богатите на калай сплави с кобалт, никел, цинк и бисмут.

32. АС рег. №53603, Г.Георгиев, Б.Козов, М.Сачков, З.Карагъзова, Бляскообразуваща добавка към кисели хипофосфитни разтвори за химическо никелиране-88г. (работата е включена към Публикациите, равностойни на монографичен труд).

Резюме: Изобретението се отнася до бляскообразуваща добавка към кисели хипофосфитни разтвори за химическо никелиране. Последното намира приложение при решаване на технически задачи, при които от отложените никел-фосфорни слоеве се изисква висока степен на блясък, например за направа на огледала за светлинни и лазерни оптически системи. Предимството на използване на създадената бляскообразуваща добавка е, че позволява отлагане на никел-фосфорни покрития с

висока степен на блясък, независимо от дебелината на покритието и продължителността на работа на разтворите, като добавката дава възможност за аналитичен контрол.

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