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## ABSTRACTS OF PUBLISHED ARTICLES

UDC 621.785.52:669.14

**The influence of the carbonic dopes on the electrothermochemical carburizing characteristics.** Kusmanov S. A., Dyakov I. G., Belkin P. N. – Problems of Materials Science, 2009, N 4 (60), p. 7–14.

The influence of the carbonic dopes concentrations on the martensitic layer thickness of the low-carbon steels after its anodic carburizing is studied. Dopes concentration changing shows the possibility of the martensitic layer thickness rise on the anodic-cemented low-carbon steels with quenching. This effect is explained from anodic dissolution of the oxide layer that decelerates of the carbon diffusion. The electrolytes contents with the longevity 10 h and practical recommended are proposed.

The presence of the carbon organic dopes in the aqueous solution with ammonium chloride result in the heat temperature and current decreasing that is explain by anion emission decreasing and the decreasing of the vapor-gas shell electrical conductivity.

*Keywords:* steel, anode cementation, carbon-burning components of electrolyte, martensite coating.

UDC 669.295:539.374.6

**Titanium alloy PT-3V with ultra-fine grained structure for waveguides of high-amplitude acoustic systems.** Naydenkin E. V., Kolomeets N. P., Ratochka I. V., Kaminsky P. P., Sharkeev Yu. P. – Problems of Materials Science, 2009, N 4 (60), p. 15–19.

The influence of severe plastic deformation by multi-axial pressing technique on structure, mechanical and acoustic properties of industrial titanium alloy was investigated. It was shown that the treatment results in the formation of homogeneous ultra-fine grained structure with average grain size of 0.37  $\mu\text{m}$  and the rise of mechanical (strength) properties of the alloy. As a consequence the increase of rupture life (multi-cycle load) of waveguides from the alloy under conditions of enhanced power density of ultrasound system is observed. It was revealed that fracture of waveguides from ultra-fine grained alloy is occurred at ultrasound power in 1.5–2 times higher than that corresponding to coarse grained one. The obtained results create the prerequisites for development on the base of ultra-fine grained titanium alloys of acoustic waveguides with improved rupture life for ultrasound systems working under conditions of high power density.

*Keywords:* severe plastic deformation, ultra-fine grained structure, mechanical properties, acoustic properties, ultrasound waveguides.

UDC 669.781`71:621.039.746:621.642

**Perspective composite materials of boron-aluminium system for transport packing containers.** Ivanov V. G., Gorynin V. I., Schastlivaja I. A. – Problems of Materials Science, 2009, N 4 (60), p. 20–27.

It is offered manufacturing process of flat boron-aluminium elements subject to opportunity of formation from it's a body of packing container for transportation and storage of SNF. The offered method of pressing in solid-liquid condition of matrix allows to solve a task of essential increasing of strength connection between composite and not reinforced end faces of boron-aluminium hexahedron (tips).

*Keywords:* transport packing containers, composite materials of boron-aluminium system, transportation and storage of spent nuclear fuel.

UDC 669.24`295`15:536.42

**Estimation of influence of iron upon structurization in Ni–Ti–Fe alloys.** Blednova Zh. M., Myshevskij I. S., Rusinov P. O. – Problems of Materials Science, 2009, N 4 (60), p. 28–35.

Is made modeling of phase structure of system Ni–Ti–Fe for estimation of opportunity of developing of effect of memory of the form in materials on the base of Ni and Ti at alloying by third element (Fe) at temperatures from 300 up to 1100 K with step 100 K.

*Keywords:* alloys of system Ni–Ti–Fe, alloying by iron, effect of memory of the form.

UDC 666.7

**Hard alloys WC–Zr<sub>1-x</sub>W<sub>x</sub>C<sub>1-y</sub>N<sub>y</sub>–Co.** Perevislov S. N., Pantelev I. B., Ordanjan S. S. – Problems of Materials Science, 2009, N 4 (60), p. 36–41.

Are received hard alloys with high physicomechanical and operational properties on the basis of system WC–Co with additives complex carbonitrides Zr<sub>1-x</sub>W<sub>x</sub>C<sub>1-y</sub>N<sub>y</sub>, preliminary synthesized of zirconium

carbide, nitride and of tungsten carbide. Parameters of wetting and temperatures of occurrence of liquid phase in system complex carbonitrides-Co are determined.

Samples of hard alloys sintered at 1400–1500°C in vacuum and determined physicomechanical properties. The maximal transverse rupture strength (2100 МПа) the alloy of 75%WC +  $Zr_{0.5}W_{0.5}C_{0.8}N_{0.2}$  + Co has at temperature of sintering 1430°C that is much higher than parameters for standard hard alloys of marks BK (1800 МПа) and TK (1500 МПа).

Trial tests have shown, that at cutting steels and alloys the tool from the developed alloys achieves increase in resistance 1.8–2.1 times in comparison with standard hard alloy T14K8.

*Keywords:* hard alloys, complex carbonitride, cobalt, synthesis, a corner of wetting, sintering, porosity, transverse rupture strength, the microstructure, cutting properties

UDC 666.7

**Structure SiC–TiC–TiB<sub>2</sub> as a base of ceramo-matrix composite materials.** Danilovich D. P., Rumiantsev V. I., Ordanjan S. S. – Problems of Materials Science, 2009, N 4 (60), p. 42–47.

In threefold structure SiC–TiC–TiB<sub>2</sub> were experimentally rated the temperature and position of a point threefold eutectic. Were studied influences of titanium boride on structural and mechanical properties of ceramics on the base of solid phase sintered silicon carbide.

*Keywords:* ceramo-matrix composite materials, titanium boride, silicon carbide, threefold eutectic.

UDC 669.35:621.762

**Receiving and properties of nano-powder of copper oxide.** Bardakhanov S. P., Lysenko V. I., Nomojev A. V., Trufanov D. Yu, Fokin A. V. – Problems of Materials Science, 2009, N 4 (60), p. 48–52.

Was researched the opportunity of receiving of a powder from copper oxide with fine-grained structure. Were studied structure and properties of received nano-powder by method of scanning electronic microscopy. Is researched interaction of nano disperse powder from copper oxide with electromagnetic radiation.

*Keywords:* copper oxide, nano disperse powder, electromagnetic radiation.

UDC 678.067:661.66

**Modification of thermoplasts and reactoplasts by fulleroids materials.** Zuev V. V., Kostromin S. V., Shlykov S. V. – Problems of Materials Science, 2009, N 4 (60), p. 53–58.

The effect of fulleroids (fullerene C<sub>60</sub>, mixture of C<sub>60</sub>/C<sub>70</sub> and fulleroids soot which used for fullerenes production) and carbon fillers (carbon black, graphite) on mechanical properties of polymer nanocomposites based on reactoplasts (epoxy resins) and thermoplasts (polyamide-12) was investigated. It was found that additives of these fillers did not influence on the properties of reactoplasts. Therefore, the tensile modulus and tensile strength of thermoplast based polymer nanocomposites are improved by about 30–40% with loading of 0.02–0.08 fulleroids materials. Best results were obtained for a mixture of C<sub>60</sub>/C<sub>70</sub>.

*Keywords:* fullerenes, epoxy resins, polyamide-12, tensile strength, nanocomposites

UDC 678.067:539.2:537.811

**A nonmetallic nanoparticles in a superficial electromagnetic field. Topological factor of mesostructures interference.** Ponomarev A. N., Yudovitch M. E., Gruzdev M. V., Yudovitch V. M. – Problems of Materials Science, 2009, N 4 (60), p. 59–64.

On a base of Maxwell's electromagnetic theory the interaction of electromagnetic and electrostatic fields with nonmetallic nanoparticles have been studied. It was founded that the nanoparticle shape is the dominant item are influencing on the interaction. The existence of giant resonance (increasing of the field strength) on the surface of torpid-like particles have founded.

*Keywords:* composite nanoparticles, electromagnetic and electrostatic fields.

UDC 666.76:621.762

**Estimation of surface energy of solid bodies upon results of size test of crushing of original and prototype.** Boiko V. F., Vlasova N. M – Problems of Materials Science, 2009, N 4 (60), p. 65–73.

Is formulated method of estimation of surface energy of solid bodies by simultaneous crushing powders of original and prototype. At using of size test samples of the crushed materials with identical

initial grain size analysis was received formula for definition of factor of surface tension of the original.

*Keywords:* solid bodies, surface energy, size test

UDC 621.791.14.053:669.71`721

**Research of temperature-time conditions of welding heating, structure and properties of metal for edges joints of aluminium-magnesian alloy fulfilled with welding by friction with hashing.**

Pavlova V. I., Alifirenko E. A., Osokin E. P. – Problems of Materials Science, 2009, N 4 (60), p. 74–88.

Were fulfilled experimental researches of thermal cycles of welding by friction with hashing joints from aluminium alloy 1561 with various technological parameters of process. Were researched structure of metal in various zones of welded joint depending on welding heating and mechanical properties of welded joints.

It was established, that formation of impervious welded seam without discontinuity flaws and adhesions on border of its joint with base metal at minimal softening of alloy in a zone of thermal influence is achieved at heating of surfaces of joined edges in a range of temperatures from 425 up to 475°C. The structure of weld metal is fine disperse, is close to equilibrium (unlike the fibrous structure elongated in direction of deformation of texture of the base metal) with the size of grain within limit from 5 up to 10 microns which assumes realization in a welded seam structural properties not less than properties of the basic metal in an initial condition.

*Keywords:* welding by friction with hashing, aluminium-magnesian alloy; thermal cycles of welding heating, structure of metal of welded joints.

UDC 669.14.018.295:621.791

**Research of chemical composition, hardness and structure of metal of welded joints from steel 15XCHД with reference to flying structures of bridges.** Sergeiev Yu. G., Sharapova D. M. – Problems of materials science, 2009, 4 (60), p. 89–100.

Was researched influence of type of backings at unilateral two-through passage machine submerged arc welding upon formation of welded seams from steel 15XCHД, their structure, chemical composition and hardness. It is shown, that process of welding on glass-cooper backings unlike welding on copper backings with other things being equal provides formation of more favorable disperse structure in root, reducing probability of formation of hot cracks, and has a number of other technical and economic advantages which are caused by high quality of formation of root.

*Keywords:* steel, metal of welded connections, flying structures of bridges, process of welding on glass-cooper backings.

UDC 621.791.92 [669.35`24+669.35`71`24]

**Neural network investigation of the VVER vessel steel embrittlement dependence on hardening.**

Obraztsov S. M., Konobeev Yu. V., Pechenkin V. A., Rachkov V. I. – Problems of Materials Science, 2009, N 4 (60), p. 101–107.

A set of experimental data on embrittlement and hardening in neutron irradiated VVER-440, -1000 vessel steels is selected from the literature. A dependence of embrittlement on hardening is investigated by neural network modeling. The positive effect of Si and Mn on ductile-brittle temperature shift is established.

*Keywords:* neutron irradiation, ferritic-perlitic steel, embrittlement, hardening, neural network modeling.

UDC 669.15–194:621.039.536.2:539.422.22

**Analysis of embrittlement materials of vessels for WWER-1000 reactors while exploitation.**

Margolin B. Z., Nikolaev V. A., Jurchenko E. V., Nikolaev Yu. A., Erak D. Yu., Nikolaeva A. V. Problems of Materials Science, 2009, N 4 (60), p. 108–123.

On the basis of literary and received experimental data were analysed embrittlement of materials while exploitation. Were examined inputs to embrittlement, caused by thermal ageing and a neutron irradiation, for the base metal and weld metal of vessels for reactors WWER-1000. Were received formulas describing shift of critical temperature of brittleness depending of time of irradiation and influence of neutrons. For weld metal with high content of nickel was received relation of factor radiating embrittlement from content of alloying elements (Ni, Mn, Si), influencing upon a degree of embrittlement of material

*Keywords:* reactor WWER-1000, temperature ageing, neutron irradiation, radiating embrittlement,

alloying elements.

UDC 669.15–194:621.039.536.2:539.422.22

**Doses relations of radiating embrittlement of Russian materials for vessels of power reactors WWER-440.** Karzov G. P., Nikolaev V. A., Jurchenko E. V. – Problems of Materials Science, 2009, N 4 (60), p. 124–135.

Was staticized analysis of generic data of results of experimental researches radiating embrittlement of materials for reactors vessels of WWER-440 after irradiation in research and industrial reactors. Are resulted the specified relations of radiating embrittlement of materials under influence of stream of neutrons in a wide range of change of the content of impurity elements (phosphorus and copper). By methods of mathematic-statistical processing it was established, that increase of critical temperature of fragility  $\Delta T_F$  as a result of a neutron irradiation at  $\sim 270^\circ\text{C}$  differs from specified gain  $\Delta T_F$  upon normative relation by kind of coefficient of radiating embrittlement. However the kind of doses relation  $\Delta T_F = A_F (F/F_0)^{1/3}$  is kept in all range of alloying and in all range of impurities content.

*Keywords:* power reactor WWER-440, radiating embrittlement, impurity elements, methods of mathematic-statistical processing.

UDC 669.295:620.194.2

**Influence of structure upon corrosion-mechanical strength of a high-strength titanium alloy of system Al–Mo–Zr–Nb–C.** Gorynin V. I., Panotskij D. A. – Problems of Materials Science, 2009, N 4 (60), p. 136–142.

In this work are resulted experimental researches of influence of type of structure upon mechanical properties and corrosion fracture strength of metal for large-sized pilot ring forging out of high-strength titanium alloy of system Al–Mo–Zr–Nb–C. Results of tests are presented as  $J_R$ - and  $\delta$ -curves, are rated values of conditional threshold coefficients of intensity of pressures at static loading in corrosion environment.

*Keywords:* titanium alloy, ring forging, coefficient of intensity of pressures, static loading in corrosion environment.

UDC 669.14.018.29:539.42

**Character of failure of structural steels with coatings.** Zhagina I. P., Lutsenko A. N., Kotelnikova L. V. – Problems of Materials Science, 2009, N 4 (60), p. 143–149.

In work are resulted the data upon influence of processing quality of a surface before plating of coating and infringement of technology of its plating on character of failure of samples from structural steels.

*Keywords:* structural steel, plating of coating, plating quality of processing of a surface, character of failure.

УДК 669.14.018.29:539.42

**Character of failure of ЭП866-Ш steel with coatings.** Zhagina I. P., Lutsenko A. N., Mubojad-zhjan S. A., Belous V. J., Kotelnikova L. V. – Problems of Materials Science, 2009, N 4 (60), p. 150–156.

Are resulted data about influence of corrosion environment, kind of loading, quality of a surface processing before plating of coating on character of failure of samples from ЭП866-Ш steel.

*Keywords:* structural steel, corrosion environment, loading, quality of surface processing, character of failure.