ABSTRACT AND REFERENCES

APPLIED PHYSICS

SELECTION OF THE OPTIMAL CRYSTALLIZATION PARAMETERS OF BARS, MADE FROM ALUMINUM ALLOYS (p. 4-7)

Olga Berezhnaya

The analysis of thermal processes in the system environment – mold – melt conducted. It was found that the mold geometry, and shrinkage processes in the ingot influence the selection of pulling speed and emergence of surface defects.

The differential equation, describing the temperature distribution along the mold length was obtained from the thermal energy balance criterion. In the derivation of the equations, the assumptions on the independence of the thermal capacity of melt on the temperature, speed constancy of the melt flow along the mold length and uniformity of temperature distribution on the bar diameter were used.

Finite ratios in the form of analytic dependencies, which set the limiting length of the mold on the melt superheat temperature, heat-conductivity coefficients, mold material and heat transfer coefficients in the environment were obtained.

Graphic dependences of the mold minimum length on the bar pulling speed, heat transfer coefficient, melt and environment temperatures were given.

The minimum length of the mold increases linearly with the increase in the bar pulling speed, environment temperature and melt temperature.

Significant reduction of the mold length is observed with the increase in the heat transfer coefficient to the value of 100 kcal/m^2·h·deg. The further increase in the heat transfer coefficient leads to the slight decrease in the mold length.

Keywords: aluminum alloys, continuous casting, mold, melt temperature, heat transfer, pulling speed.

References

1. Khahalin, V. D., Semeko, V. I., Smolyakov, A. N., Cherezov, A. S., Borovoy, N. M. (1977). Pipe foundry production. Metallurgy, 224.
2. Getselev, Z. N., Balahontsev, G. A, Kvasov, F. I., Cherepok, G. V., Varga, I. I., Martynov, G. I. (1983). Continuous casting into the electromagnetic crystallizer pan. Metallurgy, 152.
3. Skachkov, V. A., Berezhnaya, O. R., Overchuk, O. R., Kolobov, G. A. (2012). Thin bars crystallization from aluminum alloys precif sion accuracy research. Materials pressure treatment. Collection of scientific works. Kramatorsk: DSMA, №4 (33). 212 – 215.
4. Pavlicevic, M., Matijasevic, B., Kapaj, N. (1997). Hicast: a new approach to high speed casting. Rev. Met. CIT Oct. P. 1215, 1217 – 1223.
5. Gankin V., Belitshenko A., Bogdanov N. (2001).Tube-type crystallizers for a high-speed of a steel casting. Trudih VI kongressa staleplaviljthikov. M., 461 – 469.
6. Bertoletti, C., Courbe, P., Joliver, J. M. (1998). Meniscus free casting: metallurgical and technological results. 3rd Europ. Conf. Continuous Casting, 65 – 74.
7. Kondo, K., Sakamito, J., Hara, K. (1999). Designing of technology of a high-speed casting of low-alloyed steels. Dzayjre to purosehsu. W.7. №1, 280.
8. Isachenko, V. P., Osipova, V. A., Sukomel, A. S. (1981). Heat transfer. Energy, 416.
9. Samojlovich, Y. A., Krylevetskiy, S. A., Gorainov, V. A., Kabakov, Z. K. (1982). Thermal processes at continuous moulding of a steel. M.: Metallurgiya, 152.
10. Troitskiy, V. A., Zheleznov, V. A. (1984). Aluminum metallurgy. Metallurgy, 400.

ION IMPLANTATION AS A WAY TO IMPROVE THE OPERATING DURABILITY OF FINE-SIZE STEEL TOOL (p. 7-11)

Larisa Vasetskaya

The work is devoted to the improving the operating durability of a fine-size tool. The application of such tool has economic gains for the producer as leads to the decrease of bought tool expenses. Modified coatings of titanium nitride and chromium on the bases of structural steel and structural alloyed steel have been produced by the ion implantation method. The structure and physical properties of these coatings, as well as their use as protective coatings on the fine-size tool have been studied in this article. Due to the correctly chosen regimes ($U_{discharge}$ = 400 ÷ 430 V, $I_{discharge}$ = 0,5 ÷ 0,35 A, U_{target} = 2 ÷ 1,2 kV, I_{target} = 50 ÷ 60 mA, U_{base} = 25 kV, I_{base} = =35 mA, $p_{gas} = 3{,}32 \cdot 10^{-2}$ Pa), a doze of implanted ions ($2{,}0 \cdot 10^{16}$ – $-8{,}03 \cdot 10^{17}$ ion/cm^2), materials of the target(Ti and Cr) and the base (ВСт3сп and 40Cr) and as a result of carrying out experimental researches high quality protective coatings have been produced, microhardness increasing 2,5 times and wear resistance increasing 2,5 times. When using the results of work in practice wear resistance of working surfaces of the fine-size tool has been increased 3 - 6 times. The use of ion-plasma processing enables to get steel with modified protective coatings and to increase the operating durability of the fine-size steel tool and small but having key importance machine parts.

Keywords: ion implantation, titanium, chromium, modified coating, microhardness, wear resistance, operating durability.

References

1. Kuransky, E. (1980). Ion implantation in semiconductors and other materials. Moscow, USSR: World, 332.
2. Poate, J. M., Foti, G., & Jacobson, D. C. (1987). The modification and surface alloying of the laser, ion and electron beams. Moscow, USSR: Mechanical Engineering, 424.
3. Pogrebnyak, A. D. (2009). Effect of high doses of ions N^+, $N^+ + Ni^+$, $Mo^+ + W^+$ on the physico -mechanical properties of TiNi. Journal of Applied Physics, 79 (5), 65-72.
4. Williams, J. S., & Poate, J. M. (1988). Ion implantation and beam technologies. Kiev, USSR: Naukova Dumka, 360.
5. Belous, V. A., Nosov, G. I., & Azarenkov, N. A. (2010). The effect of irradiation with Ar + ions on the corrosion resistance of metals and alloys. ФІП ФИП PSE, 8 (2), 161-168.
6. Sergeeva, M. H., & Kochanowski, V. A. (2008). Nanostructured surface modification. Herald DSTU, 8 (2), 192-195.
7. D'Heurle, F. M., & Harper, J. M. (1989). Note on the origin of intrinsic stresses in films deposited via evaporation and sputtering. Thin Solid films, 171 (1), 81–92.
8. Galvanetto, E. (2001). XRD and XPS study on reactive plasma sprayed titanium – titanium nitride coating. Thin Solid Films, 384 (2), 223–229.
9. Ellwanger, R. C., & Towner, J. M. (1988). The deposition and film properties of reactively sputtered titanium nitride. Thin Solid films, 161, 289–304.
10. Grant, W. A., & Williams, J. S. (1976). The modification of surface layers by ion implantation. Sci. Prog. Oxf., 63 (249), 27–64.
11. Conrads, H., & Schmidt, M. (2000). Plasma generation and plasma sources. Plasma Sources Sci. Technol., 9, 441–454.
12. Kanaya, K. (1973). Consistent theory of sputtering of solid targets by ion bombardment using power potential Low. J. Appl. Phys., 12 (9), 1297–1306.
13. Krasilnikov, L. A., & Krasilnikov, S. A. (1977). The wiredrawer of wire. Moscow, USSR: Metallurgy, 240.

14. Topolyansky, P. A., Ermakov, S. A., & Sosnin, N. A. (2005). The hardness of the thin-film coating applied by plasma hardening finish: 7th Intern. Practical. Konf.-Exhibition on Technology of repair, restoration and strengthening of machine parts, machinery, equipment, tools and tooling, St. Petersburg, 274-298.
15. Vladimirov, V. I. (1988). Physics wear of metal surfaces. Leningrad, USSR: Physico-Technical Institute, 230.

ADAPTIVE METHODS FOR MODELLING OF TEMPERATURE FIELD OF LASER IRRADIATED PLATE (p. 12-16)

Sviatoslav Lukyanenko, Iryna Mykhailova

The result of computer modeling of the temperature field of the plate arising under the influence of a moving laser beam is considered in the paper. The comparison of the calculation results, obtained due to the application of implicit schemes of the balance method on the non-uniform adaptive grid with the experimental results was made. At the application of both schemes, two methods of interpolation of the function values - the method of Lagrange of the third degree and the Kochanek-Bartels splines were used in the construction of a new grid. The systems of algebraic equations arising in this difference scheme are solved by the modified Gaussian method in the case of linear circuit and Newton's method in the case of nonlinear circuit. The adaptive method, which «condenses» the nodes in areas with large gradient of temperatures and arranges them more sparsely in areas where the temperature varies smoothly, is used for the automatic construction of a variable of the difference grid. This allows to reduce the calculation time and to get a result with a predetermined accuracy.

The results of computer modeling showed that the nonlinear implicit scheme of the balance method, using the Kochanek-Bartels splines gives a more accurate result. We will also note that the nonlinear scheme of the balance method is a bit more time-consuming as compared to the linear as it requires the implementation of iterations of Newton's method.

Keywords: method for coordinate-splitting, adaptive method of grid construction, balance method.

References

1. Price, S. (2007). Laser forming. Journal of Manufacturing Science and Engineering, 129, 117-124.
2. Shi, Y., Shen, H., Yao, Z., Hu, J. (2007). Temperature gradient mechanism in laser forming of thin plates. Optics & Laser Technology, 39 (4), 858-863.
3. Golovko, L.F., Lukyanenko, S.O., Mykhailova, I.Yu., Tretyak, V.A. (2011). Modeling of the process of contactless laser deformation using adaptive method. Electronic modeling, 3, 71-84.
4. Mykhailova, I. (2013). Temperature field modeling with dependence of physical characteristics on temperature. Technology audit and production reserves, 5/4(13), 12-15.
5. Kalitkin, N. N. (1978). Computational methods. Moscow. USSR: Nauka.
6. Kutateladze, C. C. (1979). Basics of heat transference theory. Atomizdat.
7. Marchuk, G. I. (1988). Splitting methods. Moscow. USSR: Nauka.
8. Tihonov, A. N., Samarskii, A. A. (1977). Mathematical physics equations. Moscow. USSR: Nauka.
9. Lukyanenko, S.O. (2004). Adaptive computational methods of modeling objects with distributed parameters. Kiev. Ukraine: Politehnika.
10. Kochanek, D. H. U., Bartels, R. H. (1984). Interpolating splines with local tension, continuity and bias control. ACM SIGGRAPH, 18 (3), 33-41.
11. 65G – stal' konstrukcionnaja ressorno-pruzhinnaja – Marochnik stali i splavov. www/ URL:http://www.splav.kharkov.com/mat_start.php?name_id=265

EXPERIMETAL INVESTIGATION OF HEAT TRANSFER IN CONDITIONS OF FREE CONVECTION ON THE SURFACE OF HORIZONTAL CYLINDER (p. 17-23)

Valerii Tuz, Neilo Neilo

Despite the widespread and long-term investigation of heat transfer and hydrodynamics of a single horizontal cylinder in a large volume in conditions of free convection, both single approach to determining the intensity of heat transfer and final dependences of calculations are absent in the literature. The paper gives the results of the experimental study of heat transfer of the single horizontal cylinder in conditions of free convection in the large volume, in the range of Rayleigh numbers: $9{,}1\cdot10^3<Ra<1{,}7\cdot10^5$. The conclusion is drawn on the possibility of approximating the experimental results on one of the proposed in the literature dependences. In addition, the temperature distribution of the heat transfer agent around the cylinder was investigated. It was shown that the temperature of the medium changes sharply in the wall area and is almost unchanged in the rest of the volume. The temperature distribution is given in dimensionless coordinates, which correspond to both the most evident and the proposed in the literature. The experimental results are well coordinated with the results of mathematical modeling, presented in the literature. At the same time, comparing the results of measurements with the proposed in the literature analytical dependences of the dimensionless temperature distribution in the boundary layer, the conclusion is drawn on an underestimation of the rate of temperature change. To describe more accurately the change of the rate in the wall layer of the midship section is possible by the power dependence, with the indicator 7, not 2 - 4 as it is suggested in the literature.

Keywords: heat transfer, horizontal tube, free convection, heat emission, boundary layer.

References

1. Jaluria, Y. (1980) Natural convection: heat and mass transfer. New York: Pergamon press, 400.
2. Gebhart, B., Jaluria, Y., Mahajan R.L., Sammakia B. (1988). Buoyancy-induced flows and transport. New York: Hemisphere publishing corp., 678.
3. Van Dyke, M., (1982) An album of fluid motion. The Parabolic Press. Stanford California,. – 184 p.
4. Isachenko, V. P., Osipova, V. A., Sukomel, A. S. (1975). Heat transfer. Moscow, USSR: Energy, 487.
5. Miheev, M.A., Miheeva, I.M. (1977). Heat transfer. Moscow "Energy", 344.
6. Miheev, M.A. (1949) Heat transfer. Moscow, State energy press., 397.
7. Tsvetkov, F.F., Grigoriev B.A. (2005) Heat and Mass Transfer. Moscow, Power Engineering Institute, 550.
8. Wong, H. Y. (1977) Heat transfer for engineers. Longman Group, 213.
9. Shklover G.G., Gusev S. E. (1987) Effect of variable physical properties on heat convection around a horizontal cylinder. Journal of Engineering Physics and Thermophysics V. 53, issue 2., 902-908.
10. Paul, M. (2006). Natural convection flow from an isothermal horizontal cylinder in presence of heat generation. International Journal of Engineering Science 44 (13-14): 949-958.
11. Zhukauskas, A. A. (1982). Convective heat transfer in heat exchangers. Moscow, USSR: Science, 472.
12. Chand, J., Dharam V. (1979). Natural convection heat transfer from horizontal cylinders. Journal of chemical engineering of Japan. – Vol. 12, №3, 242–247.
13. Tuz, V.O., Neilo R.V. (2013) Reference temperature determination during
14. Natural convection. Energy: Economics, technology, ecology. №3, 2013.
15. Sesonske, A. (1961). Velocity and temperature distributions about a horizontal cylinder in free convection heat transfer. AIChE Journal, V.7, issue 2.

16. Shang, D.-Y., Wang, Bu-Xuan (1990). Effect of variable thermophysical properties on laminar free convection of gas. International journal of heat and mass transfer. V.33, issue 7., 1387-1395pp.

EXAMINATION OF FRACTURING OF LEZNYKIVSKIY GRANITE DEPOSIT WITH PROSPECTS OF MINING BLOCK PRODUCTS (p. 23-27)

Valentine Korobiychuk

For the purpose of the examination of natural blockiness, structural studies on the operating Leznikivskiy crushed-stone quarry were carried out, and documentation of 50 test pits, drilled eastwards from the quarry was studied. During these researches, the problems, associated, first of all, with the detection of fractures, fracturing areas, tectonic faults and examination of their spatial orientation were solved.

Regular changes in the deposit elements of sub-horizontal fractures were noted. The circular diagram, which is the basis for the construction of the structure diagram with the fracture density isolines was built. The estimation of granite fracturing and block output was carried out using two techniques: 1) examination of granite fractioning in the quarry within the I and III benches on the Eastern area and I bench on the Western area; 2) examination of fracturing on boreholes (index of specific rock fracturing U_{fr}, which is the sum of specific fractioning of subvertical, inclined (diagonal) and subhorizontal fractures). The spatial orientation of fractures, fracturing areas, tectonic faults, etc. was also examined. According to the specific fracturing, estimated in terms of boreholes, the blocks of the II–IV grades are practically absent, while in terms of the distance between the fractures, measured in the quarry, the output of these blocks approximates to 50-60 %.

Keywords: fractures, tectonic setting, vector diagrams of fracture systems, granite blockiness.

References

1. Antipenko, G. (1999). Mining geometry. Dnipropetrovsk : NGA, 265.
2. Antipenko, G., Nikolaeva, T. (2002). Geometrization of depposits. Dnepropetrovsk : NGA, 113.
3. Bukrinsky, V. (2002). Geometry of mineral resources. Moscow: MGU, 549.
4. Kuzmin, V. (1967). Geometrization and estimation of mineral deposits. Moscow: Nedra, 242.
5. Rilov A. (1975). Mining geometry. Moscow: Nedra, 231.
6. Ushakov, N. (1979). Mining geometry. Moscow: Nedra, 440.
7. Bakka, N. (1992). Facing stone. Geological and industrial and technological fields appraisal. Moscow: Nedra, 303.
8. Bakka, N. (1974). Prediction of blockiness in the fields of facing granite by mountain geometric methods. Dnepropetrovsk, 166.
9. Korobiychuk, V., Kisyel, O., Striha, V. (2012). Geometrization of associated minerals in conditions of Leznykivsky granite career; and and mining geometric analysis of its parameters. Bulletin of the National University of Water Management and Nature Resources Use, № 2 (58), 175–184.
10. Ukrheolohostrom (2000). Local report in terms of reserves in areas of the western and the eastern
11. Leznykivsky granite career, "Lyznikivskyy granite" for extraction of crushed stone and along the block of stone in Volodarsk -Volyn region in the Zhytomyr region. Book 1, 180.

CHANGE OF ELASTIC FELDS OF SINGLE CRYSTALS DEPENDING ON THE STRUCTURE OF BREACH CORE (p. 28-31)

Eugene Prokhorenko

The paper is related to the issues of spent nuclear fuel (SNF) storage and radioactive waste (RW) disposal. One of the aspects of changing the structure of materials when exposed to the charged-particle beam was theoretically considered. This situation is realized in the walls of SNF storage facilities and rocks, surrounding the RW storage facilities. To solve the problem of describing the geometry of the breach core, distortions around it, integral equations of elastic waves were applied. The equations, similar to the proposed are widely used in the electrodynamics when solving the problems of electromagnetic wave propagation in waveguides and their scattering on inhomogeneities. The problem was solved by numerical methods. It was assumed that the defect had the ellipsoidal shape. The displacement fields around the core of breach cluster depending on the size of this core were found. The sizes of the core are used in the given form - the ratio of semi-axes. Single crystals of cubic structure were studied. Tungsten and gold were considered as real materials. The displacement fields on their own axes <010> and <001> were counted. The areas of breach core sizes, at which they are stable and steady, were defined. The side ratio, when the stress fields around the cluster of the breach core have such orientation, which leads to the compression and reduction of the central zone of the breach, was found. Further, this can cause the core collapse. Taking into account the needs of the waste storage, such breaches are preferable since they reduce the defect formation in the material, surrounding the source of ionizing radiation.

Keywords: spent nuclear fuel storage facility, elastic waves, displacement fields, integral equations, Green's function

References

1. Prokhorenko, E. M. (2012). Conclusion of integral equalizations, describing dispersion of resilient waves in an anisotropic environment. Eastern-European journal of Enterprise Technologies.№2/10(56), 52-55.
2. Khizhnyak, N.A. (1986). Integral equations of macroscopic electrodynamics. Kiev: Scientific thought , 280.
3. Mahan, D.Gerald. (2000). Many Particle Physics. - N.Y.: Plenum Publishers, 784.
4. Wu, S.Y., Cocks, J.A., Jayanthi, C.S. (1994). General Recursive Relation for the Calculation of the Local Green's Function. Physical Review B. №49, 7957.
5. Tikhonov, A. N., Samarskiy, A. A. (1972). Equalizations of mathematical physics. M.: Science, 735.
6. Doniach, S., Sondheimer, E.H. (2004). Green's Functions for Solid State Physicists. N. Y: Imperial Colege Press, 312.
7. Phillips, P. (2012). Advanced Solid State Physics. Cambridge: University Press, 402.
8. Chaplya, Ya. I., Chernukha, O. Yu. (2009). A mathematical design of diffusive processes is in casual and regular structures. Kiev: Scientific thought, 303.
9. Lifshits, I.M., Rozentsveyg, L.N. (1947). Construction of the Green's tensor for the basic equations of the theory of elasticity in the case of an unbounded elastically anisotropic media environment. JETF, №17, V.9, 783-791.
10. Lifshits, I.M., Rozentsveyg, L.N. (1946). On the theory of elastic properties of polycrystal. JETF, №16, V.10, 967-980.
11. Muratov, R.Z. (1976).Potentials of ellipsoid. M.: Atomizdat, 286.

EFFECT OF ELECTROCHEMICAL ACTIVATION OF MIXING WATER ON THE PROPERTIES OF GYPSUM (p. 32-35)

Igor Bordun, Vadym Ptashnyk, Petro Novosad

Modern construction is characterized by the tendency of a growing share of ecologically safe materials and products. The methods of electro-physical and electrochemical action on water are promising for many industries due to the relative simplicity and environmental compatibility. Such methods are widely used for the activation of water mixing in the preparation of concrete, but their application for the activation of water mixing of gypsum binders are highlighted insufficiently. Using the anolyte and catholyte of tap water, electrochemically activated in the diaphragm electrolyzer as mixing water allowed not only to achieve the improvement of physical and mechanical properties of gypsum stone but also change the setting time of gypsum paste. It was established that the depth of electrochemical

activation plays the defining role in such changes. Thus, the control of the activation depth determines the properties of a final product. The control method was proposed, which lies in tracking the changes of the strength of current in the activation process to ensure an optimal ratio of the components regulating the setting time and hardness of gypsum stone – calcium carbonate and calcium hydroxide.

Keywords: electrochemical activation, catholyte, anolyte, mixing water, gypsum stone, setting time.

References

1. Gureva, V. A., Pomazkin, V. A., Redko L. T. (2006). The expediency of the use of physical water activation technology in building ceramics products. Journal of OSU. Natural and Technical Sciences, 2(2), 113-116.
2. Golohvast, K. S., Ryzhakov, D. S., Chajka, V. V., Gulkov, A. N. (2011). Application potential of solution electrochemical activation. Water: chemistry and ecology, 32(2), 23-30.
3. Bazhenov, Yu. M., Fomichev, V. T., Erofeev, V. T., Fedosov, S. V., Matvievskij A. A., Osipov, A. K., ... Yudin, P. V. (2012). Theoretical justification of getting concrete based on electrochemically and electro-magnetically activated water for making concrete. Internet-Vestnik VolgGASU, ser.: Multi-topic, 22(2), 5. Retrieved from http://vestnik.vgasu.ru.
4. Pimenov, A. I., Ibragimov, R. A., Izotov V. S. (2013). Effect of acg tivation mixing water and sodium sulphate on the properties of cement mortar. Proceedings of KSUAE. ser.: Building materials and products, 24(2), 247-252.
5. Ryzhakov, D .S., Gulkov, A. N., Gulyaev, V. T., Kozin, A. V., Golohvast K. S. (2009). Study of physical and chemical parameters of mixing water to electrochemical activation and effects on strength characteristics of concrete. Proceedings of the Samara Scientific Center of Russian Academy of Sciences, 5(11), 340-343.
6. Zhang, S., Liao, Z., Yang C. (2002). Experimental study about activated water generated by the electro-hydravlic impulse strengthening the mechanical performance of concrete. J. Mater. Sci. Technol, 18(4), 290-292.
7. Semenova, G. D., Sarkisov, Yu. S., Eremina, A. N., Semenov, V.D., Obrazcov, S. V., Patent RU 2163582 (2001).
8. Arbenev A. S., Patent RU 2327562 (2007).
9. Goncharuk, V. V., Malyarenko, V. V. (2001). The change of the water properties under electrochemical tratment. J. of Water Chemise try and Technology, 23(4), 345-353.
10. Poezzhalov, V. M., Burdyug, A. V. (2011). The influence of elec-tro-chemical activation degree of mixing water on the strength of the ce-ment. Retrieved from http://rep.bntu.by/bitstream/data/2112/4/6.pdf.
11. Kuznecova, T. V., Kudryashov, I. V., Timashev, V. V. (1989). Physical chemistry of cementing materials. Moscow, USSR: Vysshaya shkola, 384.

IMPACT OF SURFACE GRAVITY WAVES ON COASTAL OCEAN-TECHNICAL FACILITIES (p. 36-41)

Vladimir Kushnir, Veronika Dushko, Vadym Kramar

For reliable and long-term exploitation of ocean-technical facilities, such as towers and platforms, it is necessary to have the estimates of parameters of extreme influences from storm surface waves at their approaching the near coastal zone. Non-linear surface waves, occurring at severe storms, are mainly associated with the coastal zone of the Azov-Black sea basin, where the interaction of moving waves with the braking surface of the bed takes place. As a result of friction on the bed, the nearest to it part of the wave is braked, and the wave profile starts changing that is revealed in the increase of height of the wave, reduction of its length, the emergence of a moving crest and the breaking of the wave. Nonlinear effects of the surface gravity waves appear at the interaction of the moving wave with the bed surface. Preliminary calculations of wave parameters for the range of depths, where the interaction with the bed is shown slightly, are determined by numerical methods based on the application package ''SWAN''. The calculations of wave parameters are carried out on the basis of the empirical and half-empirical relations, given in the paper. The transformation of the system of storm waves, which have spread during the storm on November 08, 2007 eastwards to the coast of the Western Crimea, is considered as a specific example. Within the unified technique and the concrete example, the whole complex of calculations, connected with the transformation of storm waves at their entering the shallow depths and the formation of impact loads during the breaking of such waves was determined. The obtained results should be viewed as preliminary estimates with a significant amount of assumptions. Nevertheless, because of insufficient study of the problem and, considering the compliance of results with independent sources, they can be used in the problems related to the evaluation of the impact of storm waves on coastal ocean-technical and hydro-technical facilities and installations.

Keywords: surface wave, ocean-technical structures, non-linear waves, ocean-technical facilities, hydrodynamics, Korteweg-de Vries equation.

References

1. «Chernomorneftegaz»: (2013) URL: http://blackseagas.com.
2. Kushnir, V. M., Fedorov, S. V., Petrenko, L. A. (2008) The reaction The reaction of the Azov-Black Sea basin to the intense cyclone on November 10-11, 2007, from remote sensing data. Sea Trials, №1, 62-81.
3. Matishov, G. G., Savickiy, R. M., Igebeikin, U. I. (2008) Condi-tions and consequences of accidents involving vessels in the Kerch Strait in the storm November 11, 2007. Bulletin of the Southern Research Center RAS. T.4. № 3, 54-63.
4. Smirnov, A. A. (1962) Changing the height and length of the waves on gentle slopes. The research of wave. Moskow: Gosstroi-izdat, 37-60.
5. Smirnov, A. A. (1962) The depth of the collapse of the wave on the gentle slopes. The research of wave. Moskow: Gosstroiizdat, 177-184.
6. Skjelbreia L., Hendrickson, A. (1961) Fifth order gravity wave theory. Proc. VII Conference on Coastal Engineering, 184-196.
7. Dowson, T. (1986) Designing of the sea shelf. Leningrad: Shipbuilding, 286.
8. Bouden, K. (1988) Physical oceanography of coastal waters. Most cow, USSR:Mir, 324.
9. Williams, M.S., Thompson, R. S. G., Houlsby, G. T. (1998) Nonlinear dynamic analysis of offshore jack-up units. Computers & Structures. 69, № 2, 171-180.
10. Wolfram, J. (1999) On alternative approaches to linearization and Morison's equation for wave forces. Proceedings of the Royal Society of London Series A Mathematical Physical A. 455, 2957-2974.
11. Tung C.C. (1996) Total wave force on cylinder considering free surface fluctuation. Applied Ocean Res. 18, № 1, 37-43.
12. Isaacson, M., Cheung, K. F. (1994) Correction factors for nonlinear run up and wave-forces on a large cylinder. Canadian J. of Civil Engineering, 21 (5), 762-769.
13. Zhou, X. C., Wang, D. G., Chwang, A. T. (1997) Hydrodynamic interaction between two vertical cylinder in water waves. Applied Mathematics and Mechanics. 18, № 10, 927-940.
14. Harland, L.A. (1998) The extreme force on an offshore structure and its variability / L.A. Harland, P.H. Taylor, J.H. Vugts // Applied Ocean Res. 20(1-2), 3-14.
15. Shuleikin V.V. (1953) Physics of the sea. Moscow, USSR, 989.
16. SWAN. Technical documentation. Delft University of Technology, Faculty of Civil Eng. and Geosciences, Environmental Fluid Mechanics Section, 2006. 88.
17. Booij, N., Ris, R. C., Holthuijsen, L. H. (1999) A third-generation wave model for coastal regions, Part I, Model description and validation. Geoph. Research. 104(C4), 7649-7666.
18. Fedorov, S. V. (2008) Features of using SWAN model for the calculation of surface waves in the Kerch Strait. Ecological safety of

coastal and shelf areas and comprehensive utilization of resources of the shelf. №16, 303-313.
19. URL: http://big-archive.ru.
20. Yakushova, A. F., Hain, V. E., Slavin, V. I. (1988) General Geology. Moscow. MGU, 448.
21. Geological activity of the seas and oceans [Website]: The most important geological processes and their ecological features. URL: http://3ys.ru/vazhnejshie-geologicheskie-protsessy-i-ikh-ekologicheskie-osobennosti/geologicheskaya-deyatelnost-morej-i-okeanov.html.
22. Energy, Power and the power of offshore wind waves [Website]: All about the sea. URL: ehmore.ru/...volny/energiya-moshhnost-i-sila-morskix-vetrovyx-voln.html.

VERIFICATION OF METHODOLOGY FOR DETERMINATION OF REFLECTOR PROFILE OF RADIANT FLUX (p. 42-45)

Vladimir Plevako, Stanislav Kostenko, Irina Pedorich

The study of the shape of radiant flux reflector, designed for uniform total irradiation of receiver with semi-elliptical cross-section by a single radiator, was continued. Physical and computer experiments were conducted in the paper to verify previously developed analytical methodology for determining the reflector profile based on the solution of inverse problem. Using the experimental apparatus with reflector allows conducting a series of physical experiments to determine the temperature in the working chamber followed by construction of the field of irradiation density using the computer algebra system MathCad. The computer experiment, conducted for the same heat system using the optical analysis software TracePro, allows determining the same parameter. The comparison of heat flux density, produced in accordance with the developed theoretical methodology, by computer simulation and physical experimentation proves the accuracy of the developed methodology for determining the reflector profile ensuring uniform irradiation of receiver with semi-elliptical cross-section. The use of reflectors, profiled in accordance with the proved methodology, will reduce the power capacity of infrared equipment for frying food products, as well as enhance the organoleptic properties of products.

Keywords: uniform irradiation, reflector profile, semi-elliptical cross-section, experimental apparatus, computer simulation.

References

1. Berg Roger, M. (Mar 02 1982). Broiler apparatus. U.S. patent 4, 317, 441.
2. Wagner, D., Wells Harold, D. (May 12 1987). Method of infrared tunnel oven cooking of food products. U.S. patent 4, 664, 923.
3. Lawson, D. A., Ziesler, C. D. (1996). An accurate program for radiation modelling in the desigh of high-tempersature furnaces. IMA J Management Math, 7 (2), 109-116.
4. Sheridan, P., Shilton, N. (1999). Application of far infra-red radiation to cooking of meat products. Journal of Food Engineering, Vol. 41(3), 203-208.
5. Plevako, V., Kostenko, S., Pedorich, I. (2008). Fragmental reflector for uniform irradiation receiver of semi-elliptic cut. Progressive Technique and Technologies of Food Productions, Restaurant Economy and Trade, 2(8), 266–275.
6. Plevako, V., Kostenko, S., Pedorich, I. (2010). Geometrical design of surface of reflector taking into account losses of warmth. Applied Geometry and Engineering Graphic, 4, vol. 47, 51–60.
7. Plevako, V., Kostenko, S. (2009). Computer design of process of irradiation of the receiver of semi-elliptical cut. Equipment and Technologies of Food Productions, 22, 269–273.
8. Dowdy, S. M., Wearden, S. (1991). Statistics for research. New York: Wiley, 629.
9. Student. (1908). The probable error of a mean. Biometrika, 6(1), 1–25.
10. In: Driggers, R. G. (2003). Encyclopedia of Optical Engineering. New York: Marcel Dekker. 3 vols.

PRESOWING SEEDS STIMULATION TECHNOLOGY BY HIGH-FREQUENCY ELECTROMAGNETIC FIELD (p. 45-50)

Alexandr Petrovskij

On the basis of current ideas about the pre-sowing treatment of seeds with different ranges of electromagnetic fields has been offered the technology of radiation. The thermal and oscillatory effects of electromagnetic fields on the structural elements of the seeds have been showed. Positive factors which influence the processes of thermal vital functions of the seeds have been identified. A new mathematical model of temperature distribution in the layer of bulk seed during irradiation with high-frequency electromagnetic field has been offered. The model takes into account the dependence between the geometric parameters of the exciter, the output power, irradiation time, and biophysical properties of the grain, which allows simulating the object for studying and establishing of the necessary technical equipment parameters and modes of exposure. A method of pre-stimulation of seeds by high-frequency electromagnetic field has been worked out. The optimal regimes of the irradiation effect on seeds of different species and cultures have been found. Output power of the exciter is 20 - 60 W, the optimum exposure time, 2 - 12 min, for different kinds of plants at optimal heating of seeds 22 - 31 °C. On the basis of theoretical calculations and experimental studies has been proved positive result from the implementation of the technology. Seed germination increased by 10 – 27 %.

Keywords: technology, irradiation of the seeds, the model, temperature, electromagnetic field, the method germination, impact.

References

1. Beresin O. V. (2010) Effective function of the agricultural production. Economics of APK., 2, 26 – 31.
2. Adamen F. (1997) Condition and direction of seed growing develn opment in Ukraine. International agr. magazine, 2, 49 – 50.
3. Tsherenkov A. D., Kosulina N. G. (2005) Use of the informational electromagnetic fields in the technological process of agriculture. Lighting technology and electrical power engineering. Internae tional Science and Technology magazine. Kharkiv: 5, 77 – 80.
4. Intensification of the heat processes during the preparing seed for sowing using the HF and UHF (recomendation) (1989) prepared by PhD in Engineering N. V. Tsuglenko Moscow,: Agropromisdat, 40.
5. Batygin N. F., Ushakova S. I., Nikonova N. D. (1983) Integrated assessment of the influence process of high frequency electromagnetic field on the seeds. Use of the high and super high frequency in the technological processes of farming industry : theses, report. – Tshelabinsk, 71.
6. Ismailov E. S. (1987) Biophysical influence of microwave radiation. Moscow Energoatomisdat, 306 p.
7. Microwave technologies in the national economy. Adoption. Problems. Prospects (Industry, agricultural sector, medicine – formation). (2000) .Issue 2 – 3. [Articles, redaction. acadamy. MAI KaliA nin L. G.] International. acad. inform.; Piven. phil. issue prod. radio engineering MAI, Ukrainian scientific and technological center. Odessa, Kyiv, TEC, 192 .
8. Devatkov N. D., Golant M. B., Tager A. S. (1983) The role of synchronization by weak signals influence of millimeter range on the animated. By redaktion of academician N. D. Devatkov Effects of non-thermal influence of millimeter range on the biological objects. Moscow IRE Acadamy of Sciences SU, 7 – 17.
9. Tsherepnev A. S., Tsherepnev I. A., Lashenko G. A. (2008) The use of pulsed electromagnetic radiation for disinfection of grain mix. Collection of scientific papers of Kharkov Air Force University named after Ivan Kozhedub, issue 2 (17), 53 – 55.
10. Thomasset A. (1962) Proprietes bioelectriques des tissus. Mesure de l'impedance en clinique. Lyon Med. 28, 107 – 109.
11. Perelmuter V. M., Tsha V. A., Tshurikova E. M. (2009) Medical and biological aspects of the interaction of electromagnetic waves with

the body. Textbook. Tomsk: Publishing house of Tomsk Polytechnic University, 128.
12. Crop seeds. Methods for determination of quality. (2003) (ISO 4138:2002, IDT). State Standards of Ukraine ISO 4138:2002. [enacted from 2004-01-01]. Kyiv State consumer standard of Ukraine, 173. (National standard of Ukraine).
13. Patent 51700 UA MPK (2009) A01C 1/00 (2010. 07), Method of pre-irradiation of seeds of cereals. O. M. Petrovskij, A. A. Smerdov, G. P. Shemela, S. I. Volkov, A. A. Landar. owner Petrovskij O.M. Patent for useful model №51700. patented 15.02.2010; published 26.07.2010. issue. № 14 2010.
14. Petrovskij O. M., Volkov S. I., Kalinitshenko V. M. (2011) Temperature range UHF irradiation as a factor of influence on the germination of wheat. Collection of scientific papers of Vinnisa Staat Agricultural University. Series: Engineering Sciences Issue 7, Vinnisa, 24 – 28.
15. Smerdov A. A., Petrovskij O. M. (2011) Determination of optimum conditions for pre-sowing treatment by electromagnetic field. «Topical issues of Biological Physics and Chemistry» BFFC - 2011, VII International Scientific and Technical Conference. Sevastopol, 44 – 46.
16. Grigoryshyn E. V., Petrovskij A. N., Pospelov S. V., Smerdov A. A. (2013) The effectiveness of UHF irradiation of seeds Echinacea pallida. Innovative approaches to the study of echinacea: Proceedings of the International Scientific Conference. Poltava, 26 – 30.

BLACK LIMIT. PART 13. THEORY OF COLD FUSION AND CATALYTIC REACTIONS (p. 51-56)

Sergey Yalovenko

In the beginning of the paper, the main issues of the previous chapters from the author's series of studies in the field of the black limit related to the subject, studied in the paper were briefly considered.

By considering the nature of cold fusion, it was assumed that the main stumbling block lies in the Coulomb's law, in the need to overcome the force of electric charge. For this purpose, the conditions were studied, when the rate of charge at the transition from one density to another is more than the light speed in this medium, and the charge "grows bald". As a result, the Coulomb forces cease to affect and conditions for cold fusion are created.

Similar processes proceed at the chemical catalytic reactions, and lead to the acceleration of chemical reactions. Catalytic reactions are of the physical nature and are based on the change in the charge by the different medium density. This process is similar to the change in the charge distribution at $V \rightarrow S_{light}$ and, in this case, the Coulomb's law is broken since the charge remains constant, but its effect in different ways is different that can be interpreted as the charge change in different directions. Anyway, all these processes are associated with the change in the charge effect in different directions (with respect to the charge in different directions), and breaking of the Coulomb forces (or their relativity).

Keywords: cold fusion, cold fusion reaction, low-temperature nuclear reaction.

References

1. Einshtein, A. (2000). Teorija otnositel'nosti. Nauchno-izdatel'skij centr «Reguljarnaja i haoticheskaja dinamika».
2. Feynman, R., Leyton, R., Syends, M. Feynmanovskie lekcii po fizike.
3. Yalovenko, S. N. (2009). Chjornyj predel. Teorija otnositel'nosti: novyj vzgljad. Materialy Mezhdunarodnoj nauchno-prakticheskoj konferencii «Aktual'nye problemy sovremennyh nauk-2009». Nauka i studia, 21, 85.
4. Yalovenko, S. N. (2009). Teorija otnositel'nosti. Novyj vzgljad. Ural'skij nauchnyj vestnik. Nauchno-teoreticheskij i prakticheskij zhurnal, 5(20). ZhShS «Uralnauchkniga», 33.
5. Yalovenko, S. N. (2009). Chjornyj predel. Vestnik nacional›nogo tehnicheskogo universiteta «HPI», 8, 81.
6. Yalovenko, S. N. (2008). Chjornyj predel chast› 1. Vestnik nacional›nogo tehnicheskogo universiteta «HPI», 43, 144.
7. Yalovenko, S. N. (2009). Chjornyj predel. Teorija otnositel›nosti: novyj vzgljad. TOV izdatel›stvo «Fort».
8. Yalovenko, S. N. (2010). Chjornyj predel. Teorija otnositel›nosti: novyj vzgljad. Chast› 5. Mirovozzrenie. Materialy 6 Mezhdunarodnoj nauchno-prakticheskoj konferencii «Nauka i innovacii - 2010». Techniczne nauki Fizyka. Nauka i studia, 13, 105.
9. Yalovenko, S. (2013). Black limit. Part 11. Eastern-European Journal Of Enterprise Technologies, 4(5(64)), 31-36.
10. Yalovenko, S. (2013). Black limit. Part 12: The transformation expanded with lorentsevoye. Eastern-European Journal Of Enterprise Technologies, 5(5(65)), 48-55.