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DEPARTMENT OF PHYSICS

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RESEARCH GROUP IN *APPLIED PHYSICS*

Researches in *STUDIES AND INVESTIGATIONS IN SOLAR ENERGY*

Keywords: flat plat collector, stockage, heat exchanger, energy efficiency, and specific power of solar collector, energy flow rate, and specific entropy.

FIELD DESCRIPTION

A considerable part of low-potential heat requirement may be covered by solar energy in domestic and industrial area at our latitude (45 ^{0}N). It is possible that solar gain of such system attains an average of 70 kg·m^{-2}·year^{-1} of conventional fuel.

ACTIVITIES

The studies in this field have been made, at the Technical University of Timişoara, since 1976. Here has been materialized a multifunctional laboratory in order to study the new types of solar collectors and a complete system containing following segments: flat plat collectors, heat exchangers and storage heating systems. Some industrial utilization have been designed and constructed on these studies.

BOOKS

Luminosu, I., *Fizică – teorie, aplicaţii, autoevaluare*, Politehnica Publishing House, ISBN 973-625-142-X, 2004, 538 pages

PUBLISHED PAPERS

1. Luminosu, I., Borza, I., *Boilerul solar Wilco ca segment al lantului termoenergetic al clădirilor cu destinaţie socială sau de locuit,* National Conference "Building equipments and ambient comfort", "Politehnica" University of Timişoara, 2004, ISBN 973-625-052-0, pp. 310-317
2. Minea, R., Luminosu, I., But, A., *Experimental, rheological and difusional study for a ferofluid based on petroleum*, Proceedings of XLVIII ETRAN, Conference, Čačak, Serbia & Montenegro, June, 2004, IEEE, vol. IV, pp. 234-236
3. Luminosu, I., Marcu, C., *On the correlation between some thermodynamical and geometrical factors which have characterized the pebble bed storage of solar energy,* National Conference "Building equipments and ambient comfort", "Politehnica" University of Timişoara, 2004, ISBN 973-625-052-0, pp. 319-322
4. Luminosu, I., Fara, L., *Planning of a hybrid system (Solar thermal and PV) for stock raising in Romania's Western area*, EuroSun, 2004, Germany, Freiburg, Proceeding 1, ISBN 3-9809656-1-9, pp. 259-265
5. But, A., Pop, M., Dragomir, R., Cârlan, D., Luminosu, I., *The contribuitor about the position determination of main arbor under the action of different disturbing factors*, 9th International Scientific Symposium, Quality and Reability of Machines, Nitra SR, May 2004, ISBN 80-8069-195-9, pp. 10-12
6. Luminosu, I., *Proiecte, sisteme si instalaţii solare în unele ţări ale UE*, Technics of Building Equipment, 2004, ISSN-1582-6244, pp. 81-86
7. Luminosu, I., Popa Luminosu, C., *Unele instalaţii de joasă temperatură studiate în partea de Vest a României*, Technics of Building Equipment, 2004, ISSN-1582-6244, pp. 76-79

PERSPECTIVES

The energy analysis could be developed for a more complex model that would include the solar collector and the accumulator, and searching the optimal values in a four-dimension space, namely: energy efficiency, flow rate, collector area, and heat accumulator volume.

RESEARCH TEAM

- Prof. Dr. Cristian MARCU
- Lecturer Dr. Ioan LUMINOSU

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Researches in *MAGNETIC AND MAGNETOELASTIC PROPERTIES OF AMORPHOUS, NANOCRYSTALLINE AND CRYSTALLINE MATERIALS*

Keywords: amorphous and nanocristalline alloys, structural relaxation, crystallization, Mössbauer effect.

FIELD DESCRIPTION

Correlation of physical properties with amorphous CSRO and TSRO, nanocrystalline structures and investigation of kinetic processes activated by annealing was made. Magnetic and magnetoelastic properties of amorphous and nanocrystalline alloys were examined.

ACTIVITIES

Investigations of structural relaxation in FeCrPMnC ribbons and crystallization of FeCrP and FeGdB ribbons were made. Correlation of magnetic properties with structural information (by XRD, DSC, Mössbauer effect) and magnetoelastic properties were examined.

RESEARCH PROJECTS

1. CNCSIS Research Grant A137 No. 32940 / 22.06.2004 *Nanocrystalline alloys of type rare earth transition metals with the very high magnetostrictiv*, Value: 87,900,000 ROL
2. MEC Research Grant 255(408), 2004-2006, *Microsensors and actuators fabricated by nanoengineering of shape memory alloys*, Value: 260,000,000 ROL (for 2004)

PUBLISHED PAPERS

1. Damian, I, *Malus law for a real polarizer*, Scientific Bulletin of the "Politehnica" University of Timişoara, Transactions on Mathematics & Physics, Tom 49(63), fasc.2, 2004, pp. 107-115
2. Zaharie, I., *On the crystallization Kinetics of* $Fe_{60}Gd_{10}Cr_{10}B_{20}$ *amorphous alloys*, Scientific Bulletin of the "Politehnica" University of Timişoara, Transactions on Mathematics & Physics, Tom 49(63), fasc.1, 2004, pp. 74-79

PERSPECTIVES

The increasing scientific and technical interest in highly performant materials led to researches in view to elaborate new RE-TM-M (RE=Nd, Sm, Gd,…; TM=Fe, Ni, Co, Mo,…; M=B, P, C, Si) alloys. Both magnetic (Ms, Hc, Tc,...) and magnetoelastic properties of these materials are interesting for fabrication of different type of sensors and actuators.

RESEARCH TEAM

- Prof. Dr. Ioan MIHALCA
- Assoc. Prof. Dr. Aurel ERCUŢA
- Lecturer Dr. Ioan DAMIAN
- Lecturer Dr. Ioan ZAHARIE
- Assist. Dr. Simona PRETORIAN

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Researches in *ELECTRIC AND MAGNETIC PROPERTIES OF THE OXYDIC SYSTEMS*

Keywords: electric and magnetic susceptibilities, thermal treatment, and dielectric losses

FIELD DESCRIPTION

The method of measurement of the D.C. and A.C. volume resistance and of the dielectric losses (1 kHz-50 MHz) of powdery specimens and pressed specimens, experimental results interpretation and the elaboration of the theoretic model. The measurement of the magnetic susceptibility of powdery and pressed specimens, thermal treatment, the magnetic field intensity, the preparation condition and the structure dependence of the magnetic susceptibility and the interpretation of the experimental results.

ACTIVITIES

For D.C. column resistance was designed and manufactured an installation with a three electrode-measuring cell for the powders. It was realized an innovation for the measuring cell. For magnetic susceptibility study was manufactured an installation for the solid materials, which was been used for the elaboration of some thesis and scientific works and one contract.

PUBLISHED PAPERS

Cristea, M., Bîrzescu, M., Ştefănescu, M., *High purity Ni-ferrite obtained from a new organometallic precursor*, Scientific Bulletin of the "Politehnica" University of Timişoara, Transactions on Mathematics & Physics, Tom 49(63), fasc.2, 2004, pp. 79-85

PERSPECTIVES

We intend to examinate some structural and new properties of the electric and magnetic properties of some oxydic systems and the results will be used for a research project.

RESEARCH TEAM

- Prof. Dr. Minerva CRISTEA
- Lecturer Dr. Mihai BÎRZESCU
- Lecturer Dr. Mircea ŞTEFĂNESCU
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Researches in *NUCLEAR METHODS OF NON-DESTRUCTIVE CONTROL*

Keywords: non-destructive testing, X ray, gamma ray.

FIELD DESCRIPTION

Under auspices of the international Atomic Energy Agency (IAEA) there is a group of Non-Destructing Testing (NDT) led by Assoc. Prof. Dr.Vasile Dorobanţu.

The aim of this research is to get an ISO certificate and Validation of Protocols for Corrosion and Deposit Evaluation in Large Diameter Pipes by radiography using X-rays and gamma rays, as well from Co-Go an Ir-192 nuclei.

ACTIVITIES

Measurements of large diameter pipes using X-rays; measurements of large diameter pipes using Ir-192 gamma rays; two monographs published by IAEA.

RESEARCH PROJECTS

Research Contract No.12111/RO between IAEA (International Atomic Energy Agency) and the "Politehnica" University of Timişoara, Department of Physics: *Wall's thickness measurements using radiographic X-ray method for pipelines having diameter of 150-200-250-300 mm*, Value: 1,560 EURO

BOOKS

1. Dorobanţu, V., *Fizica între teamă şi respect, vol. II – Teoria Relativităţii,* Politehnica Publishing House, Timişoara, 2004, ISBN: 973-625-146-2, 127 pages
2. Drai, R., Vinge, C., Zscherpel, U., Balasko, M., Sreeramakrishnan, P., Rastkhah, N., Harnzah, Ab. R., Khan, A. A., Dorobanţu, V., Harara, H., Ekinci, S., Infazon, S., Ewert, U., Isaac Einav, *Validation of Protocols for Corrosion and Deposit Evaluation in Large Diameter Pipes by Radiography"*, International Atomic Energy Agency, IAEA, 2004, 130 pages

PUBLISHED PAPERS

Dorobanţu, V., *X-rays linear attenuation coefficient in steel. Thickness dependence*, NDT net, Online Journal of Nondestructive Testing, Dec. 2004, vol.9, No.12, http://www.net/article/vo9n12/dorobant/dorobant.htm

PERSPECTIVES

The research ends in 2005, but another contract will be available in 2006, focused on the nuclear methods of non-destructive control and digital processing of the image.

RESEARCH TEAM

- Assoc. Prof. Dr. Vasile DOROBANŢU
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Researches in *TRANSPORT PHENOMENA*

Keywords: heat transport, thermal and liquid convection fields, and multicrystalline silicon for solar cells

ACTIVITIES

Transport phenomena (especially heat transport and liquid convection) are very interesting tasks both of theoretical and applicative points of view. This branch of physics allows the implementation of different models of numerical simulation.

FIELD DESCRIPTION

Was examined numerical simulation of heat transfer in transparent and semitransparent crystal growth processes.

BOOKS

Barvinschi, F., *Fizică generală*, Orizonturi Universitare Publishing House, Timişoara, 2004, ISBN 978-638-164-1, 151 pages

PUBLISHED PAPERS

1. Le Quang, N., Goaer, G., Coustier, F., Gauthier, M., Duffar, T., Delannoy, Y., Mangelinck-Boel, N.,Barvinschi, F., *Thickness Reduction of Large Size High Efficiency Screen-printed Multicrystalline Silicon Solar Cells – Possibilities and Limitations for Industrial Production*, 19th European Photovoltaic Solar Energy Conference and Exhibition, 7-11 June, 2004, Paris, http://www.pv.conference.fr/
2. Nyari, T., Barvinschi, P., Băieş, R., Vlăzan, P., Barvinschi, F., Dekany, I., *Experimental and Numerical Results in Hydrothermal Synthesis of $CuInS_2$ Compound Semiconductor Nano-crystals*, 14th International Conference of Crystal Growth 12th International Conference of Vapor Growth Epitaxial, ICCG14-ICVGE 12, Grenoble, 9-13 August 2004, http://iccg14.inpg.fr/

PERSPECTIVES

The results of researches will be applied in the solar cell physics, also through a research grant. We will continue to examine the properties of the crystals obtained by Bridgman method.

RESEARCH TEAM

- Lecturer Dr. Floricica BARVINSCHI
- Lecturer Paul BARVINSCHI

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RESEARCH GROUP IN *THEORETICAL PHYSICS*

Researches in *MIXED QUANTUM STATES AND MULTIELECTRONICAL SYSTEMS*

Keywords: density matrix, harmonic oscillator, pseudoharmonic oscillator, Morse oscillator, and coherent states.

FIELD DESCRIPTION

Natural quantum systems are open systems and the corresponding quantum states are the mixed states. These systems, particularly the multielectronical systems, should be connected by the density matrix approach. Their trace is the quantum partition function, which contains the maximal information about the thermodynamically properties of multielectronical systems.

ACTIVITIES

Since 1978, theoretical investigation were made on the description of the multielectronical systems (particularly, diatomic molecules) by means of the density matrix approach. This approach were applied, also, to the harmonic or anharmonic oscillators, especially the pseudoharmonical and Morse oscillators. Some results were used for the elaboration of the doctoral thesis and other scientific works in the physics papers.

BOOKS

Popov, D., *Matricea densităţii – proprietăţi generale şi aplicaţii în fizica sistemelor cu multe particule*, Politehnica Publishing House, Timişoara, 2004, ISBN 973-625-133-0, 230 pages

PUBLISHED PAPERS

1. Daoud, M., Popov, D., *Statistical properties of Klauder-Perelomov coherent states for Morse potential*, International Journal of Modern Physics B, vol.18, No.3, 2004, pp. 325-336
2. Popov, D., *Pseudoharmonical oscillator and their associated coherent states*, Vinca Institute of Nuclear Sciences Bulletin, Belgrade, Serbia and Montenegro, vol.9, No 1-4, 2004, pp. 1-16
3. Popov, D., *Coherent states formalism for the pseudoharmonic oscillator*, Scientific Bulletin of the "Politehnica" University of Timişoara, Transactions on Mathematics & Physics, Tom 49(63), Fasc.2, 2004, pp. 70-78

PERSPECTIVES

The results of the present investigations will be used to begin a CNCSIS Research Grant entitled "*Contributions to the use of the coherent states formalism in the physics of quantum information"* and to publicate some scientific papers in this field.

RESEARCH TEAM

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Researches in *RELATIVISTIC TELEMETRY AND COSMOLOGICAL MODELS*

Keywords: special relativity, generalized relativity, radar detection, Doppler shift, classical and quantum fields, gauge theories

FIELD DESCRIPTION

The research work started in 1990 being concerned with the detection of fast moving objects, taking into account the relativistic effects.

Researches are aimed to the introduction of higher derivatives in modern, classical and quantum field theories.

ACTIVITIES

During the year 1994 we have studied the following problems: the possibility to use television techniques in order to detect relativistic effects; the possibility to avoid clock synchronization, by using the radar detection or the photographic detection; the behaviour of light source, mirrors incident and reflected rays moving at relativistic speeds.

Researches begin several years ago and more papers have been published on the topic (in Physical Review, Physical Letters, Nuovo Cimento and international conference papers).

Ph.D. THESIS DEFENDED

Babeţi-Pretorian, S., *Cosmological models without singularities*, Ph.D. advisor: Prof. Dr. Gheorghe Zet (University "Al. I. Cuza", Iaşi), 2004

BOOKS

Zaharie, I., *Culegere de întrebări şi probleme de fizică*, Politehnica Publishing House, Timişoara, 2004, ISBN 973-625-109-8, 350 pages

PUBLISHED PAPERS

1. Zet, G., Oprişan, C.D., Babeţi, S., *Solutions without Singularities in Gauge Theory of Gravitation*, International Journal of Modern Physics C., vol.15, No.7, 2004, pp. 1031-1038
2. Zet, G., Oprişan, C. D., Babeţi, S., *Gauge Theory of Gravitation on a Space-time with Torsion*, Bulletin of the Politehnical Institute Iaşi, Transaction on Mathematics, Theoretical Mechanics, Physics, Tom L(LIV), fasc.1-2, 2004, pp.101-110
3. Rothenstein, B., Damian, I., *Relativistic Doppler effect free of "plane wave" and "very high" frequency assumptions*, Scientific Bulletin of the "Politehnica" University of Timişoara, Transactions on Mathematics & Physics, Tom 49(63), fasc.1 (2004), pp.80-89
4. Rothenstein, R., Zaharie, I., *The Relativistic Velocity Addition Law through Special Relativity*, Journal of Theoretic Physics, vol.6-4, 2004, pp.71-79
5. Rothenstein, B., Naforniţă, C., *Three levels of understanding physical relativity: Galileo's relativity, up-to-date Galileo's Relativity and Einstein's Relativity: A historical survey*, Scientific Bulletin of the "Politehnica" University of Timişoara, Transactions on Mathematics & Physics, Tom 49(63) fasc.2 (2004), pp. 60-69

RESEARCH TEAM

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