CURRICULUM VITAE

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PERSONAL DATA

Affiliations:

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EDUCATION

Institute of Semiconductor Physics of the Siberian Department of the USSR Academy of Science, Novosibirsk (Dissertation: "Optical and electric phenomena in the electric fields in semiconductors with deep centers"). October 1975, **Doctor of Science: Physics and Mathematics**

Institute of Theoretical and Experimental Physics, Moscow (Dissertation: "Mechanisms of the direct reactions with two nucleons transfer"). June 1966, **Ph.D. in Nuclear Physics**

Moscow State University, Department of Physics, Moscow. January 1960, **M.Sc. in Physics**

EXPERIENCE

2005 – present	Senior Researcher, USPolyResearch, USA
1979 – present	Head of Laboratory of Membrane Processes. Karpov Institute of Physical Chemistry, Moscow.
1997 – present	Professor in Physics. Russian University of Friendship, Moscow
1990 – 1994	Professor in Molecular Physics. Moscow Engineering Physical Institute, Moscow
1969 – 1979	Senior Scientific Researcher. Institute of Physical Chemistry, the USSR Academy of Science, Moscow.
1963 – 1969	Staff Scientific Researcher. Karpov Institute of Physical Chemistry, Moscow.

EDITORIAL BOARDS

1. Russian Journal of Physical Chemistry, 1988 - present
2. Russian Journal of Electrochemistry, 1988 - present
3. Russian Colloid Journal 1988 - present
4. Chemistry and Technology of Water (Kiev) 1994 - present

AWARDS

1. Prize of the Russian Federation Government in the field of Science and Technology. 1995.
2. Honored Scientist of the Russian Federation. 1998.
3. Ernest Oppenheimer Memorial Trust (WD Wilson Visiting Fellowship, South Africa). 1996.

MONOGRAPHS

1. Timashev S.F., *Flicker-Noise Spectroscopy: Information in Chaotic Signals*, Fizmatlit, Moscow, Russia, 2008 [In Russian].
2. S.F.Timashev. *Physical Chemistry of Membrane Processes*. Ellis Horwood. Chichester, 1991. 246p.
3. A.A.Ovchinnikov, S.F.Timashev, A.A.Belyy. *Kinetics of diffusion controlled Chemical Processes*. Nova Science Publishers. Commack. 1989. 239p.
4. N.N.Tunitsky, V.A.Kaminsky, S.F.Timashev. *Methods of physico-chemical kinetics*. (in Russian). Moscow. Khimia. 1972. 198p.

RESEARCH INTERESTS AND LIST OF MAIN PUBLICATIONS

(the total number of publications - 300)

I. Informative Noise Spectroscopy.

Chaotic series (time series, spatial relief, chaotic energetic spectra) obtained under studying dynamics of complex physico-chemical and natural phenomena, among other chaotic signals, contain much information. What type of information is hidden within a chaotic signal? In what way this starting information could be extracted from the series of measured dynamic variables as a base for phenomenological study of phenomena under consideration? For solving these problems a new phenomenological approach – Flicker-Noise Spectroscopy based on introducing a new image of information was developed. FNS could be considered as a new informative technology for extracting information contained in chaotic signals. This information is formed by sequences of distinguishing type of these signal irregularities – spikes, jumps, and discontinuities of derivatives of different orders – at all space-time hierarchical levels of systems, was developed. The ability to distinguish irregularities means that parameters or patterns characterizing the totality of properties of the irregularities are distinguishably extracted from the power spectra $S(f)$ (f – frequency) and difference moments $\Phi^{(p)}(\tau)$ (τ – temporal delay) of the p^{th} order. It was shown that FNS method can be used to solve the problems of three types: show of the parameters characterizing dynamics and peculiarities of structural organization of open complex systems; display of the precursors of the sharpest changes in the states of open dissipative systems of different nature on the base of a priori information about their dynamics; show of redistribution dynamics in distributed systems by analysis of dynamic correlations between various chaotic signals measured simultaneously.

1. Timashev, S. F. and Polyakov, Yu. S., "Analysis of Discrete Signals with Stochastic Components using Flicker Noise Spectroscopy", *International Journal of Bifurcation and Chaos*, in press.
2. Timashev, S. F. and Polyakov, Yu. S., "Review of Flicker Noise Spectroscopy in Electrochemistry", *Fluctuation and Noise Letters*, 2007, Vol. 7, No. 2, R15-R47.
3. Yulmetyev, R. M., Demin, S. A., Panischev, O. Yu., Hänggi, P., Timashev S.F., and Vstovsky, G. V., "Regular and stochastic behavior of Parkinsonian pathological tremor signals", *Physica A*, 2006, Vol. 369, pp. 655-678.

4. Timashev S.F. *A New Dialogue with Nature*. In: D.S. Broomhead, E.A. Luchinskaya, P.V.E. McClintock, T. Mullin, Eds. Stochaos: Stochastic and Chaotic Dynamics in the Lakes. American Institute of Physics, Melville, NY, 2000, p.238-243.
5. Timashev S.F. *A Self-Similarity in Nature*. Ibid. p.562-566.
6. Timashev S.F. *Flicker-Noise spectroscopy as a tool for analysis of fluctuations in physical systems*. In: G. Bosman, Ed. Noise in Physical Systems and 1/f Fluctuations – ICNF 2001. World Scientific. New Jersey-London. 2001. P.775-778.
7. Timashev S.F. *On the microscopic origin of the Second Law*. In: Quantum Limit to the Second Law. Ed. D.P. Sheehan. American Institute of Physics. 2002. P. 367-372.
8. Timashev S.F., Vstovsky G.V., Belyaev V.E. *Informative essence of chaos*, in: J. Sikula, ed. Noise and Fluctuations – ICNF 2003, Prague. Czech Noise Research Laboratory, Brno University of Technology. 2003. P. 77-80.
9. Timashev S., Vrobel S. A New Dialogue with Nature: Fractal Time and Flicker Noise Spectroscopy. The Institute for Fractal Research. IF Paper 1/04 (ISSN 1436 -1779). 2003. 180p.: home.t-online.de/home/Susanne.Vrobel/home.htm
10. Descherevsky A.V., Lukk A.A., Sidorin A.Ya., Vstovsky G.V., Timashev S.F. *Flicker-noise spectroscopy in earthquake prediction research*. Natural Hazard and Earth System Sciences. 2003, V. 3, N 3/4, P.159-164.
11. Telesca L., Lapenna V., Timashev S., Vstovsky G., Martinelli G., *Flicker-Noise spectroscopy as a new approach to invistigate the time dynamics of geoelectric signals measures in seismic areas*. Physics and Chemistry of the Earth. 2004. V.29. P. 389-395.
12. Timashev S.F., Solovieva A.B., Vstovsky G.V. *Informative "passport data" of surface nano- and microstructures*, in: J. Sikula and Levinshtein M. eds. Advanced Experimental Method for Noise Research in Nanoscale Devices, Kluver Academic Publisher. Printed in Netherlands. 2004. P. 177-186.
13. Klochikhin V.L., Pososhkov I.V., Lakeev S.G., Timashev S.F. The relation between formal kinetic parameters of relaxation processes in a medium with traps and fluctuation parameters calculated by the Monte Carlo method. Russian Journal of Physical Chemistry. 2004. V. 78, No. 5. P. 821-826.
14. Parkhutik V., Collins B., Sailor M., Vstovsky G., Timashev S. *Analysis of morphology of porous silicon layers using flicker-noise spectroscopy*. Physica Status Solidi (a). 2003. V.197. N 1. P.88-92.
15. Timashev S.F., Grigoriev V.V., Budnikov Ye.Yu. *Flicker-Noise Spectroscopy in analysis of fluctuation dynamics of electric potential in electromembrane system under "overlimitting" current density*. Russian Journal of Physical Chemistry. 2002. V. 76, No. 3. P. 554-561.
16. Parkhutik V., Rayon E., Ferrer C., Timashev S., Vstovsky G. *Forecasting of electrical breakdown in porous silicon using flicker-noise spectroscopy*. Physica Status Solidi (a). 2003. V.197. N 2. P. 471-475.
17. Timashev S.F., Vstovsky G.V. *Flicker-Noise Spectroscopy in analysis of chaotic time series of dynamic variables and the problem of "signal-noise" relation*. Russian J. Electrochemistry. 2003. V. 39. No. 2. P. 156-169.
18. Letnikova A.F., Vstovsky G.V., Timashev S.F., *Formation of anisotropic fractal structures during the dissolution of LiF crystals*, Materials Science (Medziagotyra) (Kaunas), **7** (2001) 98-103.
19. Timashev S.F. *Flicker-Noise spectroscopy in analysis of chaotic fluxes in distributed dynamical dissipative systems*. Russian Journal of Physical Chemistry. 2001. V. 75, No. 10. P. 1742-1749. C. 1900-1908.
20. S.F.Timashev. *Flicker-Noise as an indicator of the "Time Arrow". Metodology of the time series analysis on the base of the deterministic chaos theory*. Mendeleev Chemistry Journal. 1997. V. 41. N3. P.17-29.

21. Sukhanov A.D., Timashev S.F. *On the fractal meaning of the anomalous diffusion*. Communication of the Joint Institute for Nuclear Research. Dubna. E4-99-167. 1999. 7p.
22. Kiselev V.F., Timashev S.F. *Nanostructures: heterogeneity and fluctuations*. Russ. J. Phys. Chem. 1995. V.69. P.1927-1941.
23. Timashev S.F. *Flicker-Noise and Fibonacci sequence*. Russ. J. Phys. Chem. 1995. V.69. P.2260-2261.
24. Timashev S.F., Kotova S.N., Solovieva A.B. et.al. *Deterministic quantum chaos in the system of vibration-rotation levels of porphyrin molecules according to IR spectroscopy data*. Russian Journal of Physical Chemistry. 2000. V.74, Suppl.1. P.S.1-12.
25. V.L. Klochikhin, S.G. Lakeev, S.F. Timashev, R.V. Zaripov. *Fluctuation dunamics of the Ising two-dimensional spin model.* Russian Journal of Physical Chemistry. 2000. V.74, Suppl.1. P.S.13-19.
26. S.F. Timashev, Y.Yu. Budnikov, V.L. Klochikhin, S.G. Lakeev, et al. *Evolution of the dynamic dissipative systems as a temporal* "*colour*" *fractal*. In: Mathematical models of non-linear excitation, transfer, dynamics and control in condensed systems and other media. Editors L.A.Uvarova, A.E.Arinstein, A.V.Latyshev. 1999. New York: N.Y.: Kluver Academic / Plenum Publishers. 1999. P.17-50.
27. Timashev S.F. *Complexity and Evolutionary Law for Natural Systems*. In: Annals of the New York Academy of Science, V.879, June 30, 1999. "Tempos in Science and Nature: Structures, Relations, and Complexity". P.129-143.
28. Parkhutik V., Budnikov E.Yu., Timashev S.F. *Application of flicker-noise spectroscopy in studies of porous silicon growth and properties*. Materials Science and Engineering. 2000. V.B69-70. P.53-58.
29. Parkhutik V., Timashev S., Nadal A., Ferrer C., Budnikov Ye., Colomina F. *Flicker-noise spectroscopy – a new method of studying non-stationary effects in electrical conductivity of oxides*. Microelectronics Reliability. 2000. V.40 (4-5). P.601-604.
30. Kostuchenko I.G., Timashev S.F. *The Comparative Analysis of Dynamic Characteristics of Solar-Terrestrial Processes.* The Chaotic Universe: Proceedings of the Second ICRA Network Workshop. Advanced Series in Astrophysics and Cosmology, Vol. 10. Eds. V.G. Gurzadyan and R. Ruffini. Singapore: World Scientific. 2000. P.579-589.
31. Parkhutik V., Timashev S.F. *Kinetics of porous silicon growth studied using flicker-noise spectroscopy*. Journal of Applied Physics. 2000. V.87. P.7558-7566.
32. Kostuchenko I.G., Timashev S.F. *Flicker-noise in processes of solar activity*. International Journal of Bifurcation and Chaos. 1998. V.8. P.805-811.
33. Timashev S.F., Bessarabov D.G., Sanderson R.D., Marais S., Lakeev S.G. *Description of non-regular membrane structures: a novel phenomenological approach*. Journal of Membrane Science. 2000. V.170(2), P.191-203.
34. Klochikhin V.L., Lakeev S.G., Timashev S.F. *Flicker-noise in chemical kinetics*. Russ. J. Phys. Chem. 1999. V.73. №2. P.224-231.

II. Physical Chemistry of Membrane Processes.

For the first time the base regularities of the processes of membrane separation were determined for the conditions of intensive mass and electromass transfer regimes, when quasiequilibrium concepts, based on linear thermodynamics of nonequilibrium processes, become inadequate. It was shown how, under these conditions, the modification of the membrane surface proves effective and the control over transport processes become viable due to the formation of a submicroheterogeneous structure of the membrane material. As a result, membrane transport acquired features typical of molecular and ionic transport in the most effective biological membranes with respect to the route (along submicrochannels) and general kinetic trends. It was shown that principal new potentialities of superselective separation of the components may be the use of submicroscopic (thickness 10-100 nm) membrane barrier layers with a fairly rigid and dense structure. In that case components pass

effectively across the membrane only in those regions where the fluctuating repulsive force field is weakened because of a lower local concentration of repulsive centers, and the selectivity of the membrane proves to be exponentially dependent on the membrane thickness. At first a new phenomenon of switching conductivity for surface-modified ion exchange polymeric membrane was discovered. The effect consists of a jumpwise reversible transition of the system from a high-ohmic to a low-ohmic state and is induced by an electric field whose intensity exceeds some threshold value. A new class of membrane processes with active, energy depending separation of neutral vapor or gaseous components through ion-exchange membranes and extraction into the vapor-gas medium was predicted and later the electropervaporation effect was discovered experimentally. It was shown the related membrane processes may be used in ammonia hydrometallurgy.
It was proposed that the active ion transport in biological membranes is influenced decisively by the local electric field within the membrane. By means of redistribution of the charge density (after ATP hydrolysis reaction, photo excitation etc.) and by the creation of additional local fields, the "mild" utilization of the energy evolved in the biological system in a wide variety of energy-dependent processes occurring *in vivo* is achieved. This principle was demonstrated in analysis of the function of transport enzymes in membranes - Na+, K+-ATPhase, Ca2+-ATPhase, H+-ATPhase, bacteriorodopsin, in the case of nitrogenase.

1. S.F.Timashev. *Physical Chemistry of Membrane Processes*. Ellis Horwood. Chichester, 1991. 246p.
2. S.F.Timashev, V.V.Valuev, A.V.Vorobiev et.al. *Pervaporation induced by electric current*. J. of Membrane Science. 1994. V. 91. P.249-258.
3. S.F.Timashev. *The role of inner electric fields in kinetics of biological processes*. Sov. Biophysica. 1981, V.26, P.642-646.
4. S.F.Timashev. *The role of inner electric fields in the charge transfer along the mitochondrial respiratory chain*. Ibid. 1981, V.26, P.1037-1042.
5. S.F. Timashev. *Membrane gas separation processes induced by electric current*. Russian Journal of Physical Chemistry, 1991, vol. 65, no. 12, p. 1741-1744.
6. S. Timashev, A. Vorobiev, V. Kirichenko et. al, *Specifics of highly selective ammonia transport through gas-separating membranes based on perfluorinated copolymer in the form of hollow fibers*. J. of Membrane Science, 1991, vol. 59, p. 117-131.
7. O.V. Bobreshova, P.J. Kulintsov, S.F. Timashev. *Non-equilibrium processes in the concentration - polarization layers of the membrane / solution interface*. J. of Membrane Science, 1990, vol. 48, p. 221-230.
8. S.F. Timashev. *From biological to synthetic membranes*. Russian Chemical Reviews (British Library), 1988, vol. 57, no. 6, p. 876-902.
9. S.F. Timashev. *Membrane technology in the resolution of nature conservancy problems*. Russian Chemical Reviews (British Library), 1991, vol. 60, no. 3, p. 295-300.

III. Kinetics of Chemical Processes.

The stochastic Kramers theory (diffusion in the energy space) of the chemical transformation elementary act is developed. For the first time the role of intermittency effects – dynamic athermical fluctuations in the kinetics of activated chemical reactions in condensed mediums is revealed. The intermittency effects are shown to control the low temperature limit of chemical reactions with heavy particles (chlorine, bromine) transfer in solids, the kinetic of chemical transformations in stratospheric aerosols etc.) On the basis of the knowledge of discrete character of elementary diffusional transfers for the first time the most general boundary conditions were derived. These boundary conditions are used in analysis of different processes of mass and electromass transfer. The role of effects of the initial density fluctuation of reagents in chemical kinetics is ascertained.

1. A.A.Ovchinnikov, S.F.Timashev, A.A.Belyy. *Kinetics of diffusion controlled Chemical Processes*. Nova Science Publishers. Commack. 1989. 239p.
2. N.N.Tunitsky, V.A.Kaminsky, S.F.Timashev. *Methods of physico-chemical kinetics*. (in Russian). Moscow. Khimia. 1972. 198p.
3. S.F. Timashev. *Intermittency in the kinetics of solid-state chemical reactions*. Russian Journal of Physical Chemistry, 1992, V. 66, N. 3, p. 454-456.
4. S.F. Timashev, L.I. Trakhtenberg. *On low temperature limit of chemical transformation in solid*s. Ibid., 1993, V. 67, N.3.
5. S.F. Timashev. *On thermofluctuative origin of solids destruction*. Doklady Akademii Nauk SSSR, 1984, V. 246, P. 898-902.
6. S.F. Timashev. *The role of athermical fluctuations in chemical low temperature kinetics*. Ibid., 1985, V. 281, P. 112-117.
7. Solovieva A.B., Timashev S.F. *Catalyst systems based on immobilized porphyrins and metalloporphyrins*. Russian Chemical Reviews. 2003. V. 72. N 11. P.965-984.
8. Belyy A.A., Timashev S.F. *Fractal Shot Noise in Chemical Kinetics*. Russ. J. Phys. Chem. 1999. V.73. №2. P.232-234.
9. Gutman E.E., Perov S.P., Timashev S.F. *Biosphere dynamics and chemical sensors*. Sensors and actuators. 1995. V.B24-25. P.162-165.
10. S.F. Timashev. *Intermittency in the kinetics of solid-state chemical reactions*. Russian Journal of Physical Chemistry, 1992, vol. 66, no. 3, p. 454-456.

IV. Quantum phenomenon in solids.

A set of quantum effects (later discovered experimentally in A.Ioffe Physico-Technical Institute, St.Petersburg and in Kiev Institute of Semiconductors), controlling a number of electric and optical phenomena in strong electric fields - red shift of luminescent band in semiconductors, anomalously high rates of anodic dissolving in wide-zoned semiconductors of n-type and the others. The controlling role of quantum effects for formation of electron density distribution in the metal-medium boundary is shown, and owing that one of old problems of quantum mechanics was solved: the nature of nonequivalence of the Thomas-Fermi model in its classic variant with quantum and exchange corrections was revealed and the adequate representations for electron density in the vicinity of the boundary were found.

1. S.F.Timashev. *On the thermic ionization of the* “*deep*” *centers in semiconductors in the presence of intensive electric fields*. Sov. Solid State Physics, 1972, vol. 14, p. 2621-2625.
2. S.F. Timashev. *On the light absorption by the* “*deep*” *centers in semiconductors in the presence of intensive electric fields*. Ibid. 1972, V. 14, P.2621-2625.
3. S.F. Timashev. *On the strike ionization of the* “*deep*” *centers in semiconductors in the presence of intensive electric fields*. Ibid., 1973, V.15, p.1106-1110.
4. S.F.Timashev.*On the switching mechanism in the high compensated semiconductors*. Sov. Phys. Semiconductors, 1976, V.10, P.741-742.
5. S.F.Timashev. *The electric potential distribution on the metal-vacuum interface*. Soviet Journal of Electrochemistry, 1979, V.15, P.730-732.

V. Global Changes.

The conception of existing connections in biosphere is developed on the intrinsic unity of the inorganic matter on the Earth and the living matter on all space-time levels of organization in the Earth – atmosphere system as a thermodynamically open ones, involved in exchange of both radiation (as is usually assumed) and also matter with space. Apart from solving of traditional chemical problems associated with the development of resource-saving and low-waste technologies and sensor systems for the monitoring of the natural environment, the physico-chemical aspects of the dynamics of natural systems were analyzed and the role of chemical factors in their evolution were elucidated. Parameters usually defined as limiting permissible concentrations, characterizing respectively the self-protecting properties of the environment and individual organisms was introduced on the basis of non-linear models of nonequilibrium thermodynamics. A new concept of the "limiting permissible utilization" of vital resources was proposed. It was shown that the processes in biosphere and the phenomena outside biosphere (deep within the Earth, in the higher atmospheric layers, and in near-Earth space) are controlled by solar phenomena and solar-terrestrial links. The models of the links have been proposed. The role of chemical factors in the evolution of natural systems is established.

1. S.F. Timashev. *The role of chemical factors in the evolution of natural systems* (*chemistry and ecology*). Russian Chemical Reviews (The British Library), 1991, vol.60, no.11, p.1183-1204.
2. S.F. Timashev, *The Physical Chemistry of Global Changes in the Biosphere*. Russian J. of Physical Chemistry, 1993, vol.67, no.1, p.145-149.
3. Timashev S.F. *On basic principles of "New Dialogue with Nature"*. IN: Problems of Geophysics in the XXI century. Ed. A.B. Nikolaev. M.: "Nauka". P. 104-141.
4. Timashev S.F. *Transcendence as a basic conception of the science in the XXI century*. Ed. A.A. Oksogoev. Tomsk: TSU. P. 21-48. 2002.