

## Павел Юрьевич Бутягин



**30 июня 1921-18 марта 2013**

18 марта 2013 года не стало Павла Юрьевича Бутягина – одного из основателей советской школы механохимии. Исследования, выполненные П.Ю.Бутягиным и его учениками, лежат в основе современных представлений о механизме механохимических процессов и об элементарных химических реакциях, протекающих в условиях интенсивных механических нагрузок.

Свою научную деятельность П.Ю.Бутягин начал в Коллоидно-электрохимическом институте АН СССР (1944-49). Он сразу оказался в удивительной творческой атмосфере, создаваемой крупнейшими учеными того времени - П.А.Ребиндером, Б.В.Дерягиным, Ф.Ф. Волькенштейном, С.Ю.Еловичем и др. Эти годы заложили основу научной самостоятельности и нестандартности мышления П.Ю. Бутягина.

После вынужденного перерыва в научной работе (как сына «врага народа») П.Ю.Бутягин вернулся в Академию наук в 1958 г., поступив на работу в Институт химической физики, где и проработал до конца жизни. Научный коллектив, созданный П.Ю. Бутягиным, успешно развивал различные разделы механохимии. Эти исследования позволили кардинально расширить представления о твердофазных механохимических процессах. Удалось разработать оригинальную аппаратуру для механической обработки материалов в широком диапазоне температур (от 77 К) в контролируемой атмосфере и позволившей привлечь современные физические методы (ЭПР, ИК, оптика и др.) анализа дефектной структуры и реакционной способности. В результате были идентифицированы активные центры при механической активации многих классов органических и неорганических веществ, исследованы направление и кинетика их превращений. Удалось

обнаружить колебательно и электронно-возбужденные состояния при механических воздействиях на вещество, провести количественный анализ механоактивированных хемосорбции и катализа, а также механохимического синтеза. Необходимо особо выделить представления об энергетическом подходе к механохимическим реакциям и их энергетических выходах.

Около 50 лет Павел Юрьевич читал лекции для студентов МФТИ, а последние годы – на факультете «Наук о материалах» МГУ. Его ученики работают в самых разнообразных научных учреждениях России и мира. Многие из них являются ведущими учеными в своих областях науки. Под его руководством защищено более 20 кандидатских и 4 докторских диссертаций. Талантливый педагог, он учил студентов не только химической физике твердого тела, но и достойному и честному отношению к жизни и любви к науке.

П.Ю.Бутягин являлся председателем Советской механохимической ассоциации, был одним из организаторов регулярных Всесоюзных конференций по механохимии и механоэмиссии твердых тел и международных конференций INCOME (International Conference on Mechanochemistry), членом нескольких ученых советов и редакционной коллегии Коллоидного журнала. Он лауреат Государственной премии России, премии Президиума РАН им. П.А.Ребиндера, премии «Наука/ Интерпериодика».

Один из «отцов – основателей» современной механохимии, организатор и многолетний руководитель лаборатории кинетики механохимических процессов ИХФ РАН, Павел Юрьевич останется в нашей памяти увлеченным, талантливым исследователем, обладавшим широкой эрудицией, в высшей степени доброжелательным, скромным, тактичным, порядочным и по-настоящему интеллигентным человеком.

### **Список основных публикаций:**

- 1. STRELETSKII, AN; BUTYAGIN, PY.**  
THE KINETICS AND MECHANISM OF MECHANOCHEMICAL DISSOLUTION OF CHROMIUM IN NICKEL  
COLLOID JOURNAL 75(3), 339-344 (2013)
- 2. BORUNOVA, AB; STRELETSKII, AN; MUDRETSOVA, SN; LEONOV, AV; BUTYAGIN, PY.**  
LOW-TEMPERATURE MECHANOCHEMICAL SYNTHESIS OF NANOSIZED SILICON CARBIDE  
COLLOID JOURNAL 73(5), 605-613 (2011)
- 3. STRELETSKII, AN; KOLBANEV, IV; PERMENOV, DG; POVSTUGAR, IV; BORUNOVA, AB; DOLGOBORODOV, AY; MAKHOV, MN; BUTYAGIN, PY.**  
THE REACTIVITY OF AL-BASED "MECHANOCHEMICAL" NANOCOMPOSITES  
REVIEWS ON ADVANCED MATERIALS SCIENCE 18(4), 353-359 (2008)
- 4. STRELETSKII, AN; MUDRETSOVA, SN; POVSTUGAR, IV; BUTYAGIN, PY.**  
MECHANOCHEMICAL ACTIVATION OF ALUMINUM: 5. FORMATION OF ALUMINUM CARBIDE UPON HEATING OF ACTIVATED MIXTURES  
COLLOID JOURNAL 68(5), 623-631 (2006)

5. **STRELETSKII, AN; POVSTUGAR, IV; BORUNOVA, AB; LOMAEVA, SF; BUTYAGIN, PY.**  
MECHANOCHEMICAL ACTIVATION OF ALUMINUM. 4. KINETICS OF MECHANOCHEMICAL SYNTHESIS OF ALUMINUM CARBIDE  
COLLOID JOURNAL 68(4), 470-480 (2006)
6. **BUTYAGIN, PY.**  
FROM SPONTANEOUS DISPERSION TO MECHANICAL ALLOYING  
COLLOID JOURNAL 68(4), 397-403 (2006)
7. **STRELETSKII, AN; KOLBANEV, IV; BORUNOVA, AB; BUTYAGIN, PY.**  
MECHANOCHEMICAL ACTIVATION OF ALUMINUM: 3. KINETICS OF INTERACTION BETWEEN ALUMINUM AND WATER  
COLLOID JOURNAL 67(5), 631-637 (2005)
8. **BUTYAGIN, PY; STRELETSKII, AN.**  
THE KINETICS AND ENERGY BALANCE OF MECHANOCHEMICAL TRANSFORMATIONS  
PHYSICS OF THE SOLID STATE 47(5), 856-862 (2005)
9. **STRELETSKII, AN; KOLBANEV, IV; BORUNOVA, AB; LEONOV, AV; BUTYAGIN, PY.**  
MECHANOCHEMICAL ACTIVATION OF ALUMINUM: 1. JOINT GRINDING OF ALUMINUM AND GRAPHITE  
COLLOID JOURNAL 66(6), 729-735 (2004)
10. **STRELETSKII, AN; PIVKINA, AN; KOLBANEV, IV; BORUNOVA, AB; LEIPUNSKII, IO; PSHECHENKOV, PA; LOMAEVA, SF; POLUNINA, IA; FROLOV, YV; BUTYAGIN, PY.**  
MECHANICAL ACTIVATION OF ALUMINUM: 2. SIZE, SHAPE, AND STRUCTURE OF PARTICLES  
COLLOID JOURNAL 66(6), 736-744 (2004)
11. **BUTYAGIN, PY; POVSTUGAR, IV.**  
REACTIVITY OF SOLIDS IN MECHANOCHEMICAL SYNTHESIS PROCESSES  
DOKLADY CHEMISTRY 398, 196-199 (2004)
12. **PIVKINA, A; STRELETSKII, A; KOLBANEV, I; UL'YANOVA, P; FROLOV, Y; BUTYAGIN, P; SCHOONMAN, J.**  
MECHANOCHEMICALLY ACTIVATED NANO-ALUMINIUM: OXIDATION BEHAVIOUR  
JOURNAL OF MATERIALS SCIENCE 39(16-17), 5451-5453 (2004)
13. **POVSTUGAR, IV; BUTYAGIN, PY.**  
MECHANICAL ALLOYING OF FE-TRANSITION METAL SYSTEMS: THE ANALYSIS OF DIFFERENT STAGES  
JOURNAL OF MATERIALS SCIENCE 39(16-17), 5461-5465 (2004)
14. **STRELETSKII, AN; KOLBANEV, IV; BORUNOVA, AB; BUTYAGIN, PY.**  
MECHANOCHEMICALLY ACTIVATED ALUMINIUM: PREPARATION, STRUCTURE, AND CHEMICAL PROPERTIES  
JOURNAL OF MATERIALS SCIENCE 39(16-17), 5175-5179 (2004)
15. **POVSTUGAR, IV; YELSUKOV, EP; ZHERNOVENKOVA, YV; BUTYAGIN, PY.**  
INITIAL STAGE OF MECHANICAL ALLOYING IN FE(80)X(20) (X = NB, TA) SYSTEMS  
COLLOID JOURNAL 66(2), 197-203 (2004)
16. **BUTYAGIN, PY.**  
DIFFUSION AND DEFORMATION MODELS OF MECHANOCHEMICAL SYNTHESIS  
COLLOID JOURNAL 65(5), 648-651 (2003)
17. **POVSTUGAR, IV; YELSUKOV, EP; BUTYAGIN, PY.**  
INITIAL STAGE OF MECHANICAL ALLOYING IN FE(80)X(20) (X = MO, W)

SYSTEMS

COLLOID JOURNAL 65(3), 358-365 (2003)

18. **BUTYAGIN, PY; ZHERNOVENKOVA, YV; POVSTUGAR, IV.**  
WORK OF FORMATION OF GRAIN BOUNDARIES UPON METAL PLASTIC DEFORMATION  
COLLOID JOURNAL 65(2), 141-144 (2003)
19. **POVSTUGAR, IV; BUTYAGIN, PY; DOROFEEV, GA; ELSUKOV, EP.**  
KINETICS OF THE INITIAL STAGE OF MECHANICAL ALLOYING IN THE FE(80)ZR(20) SYSTEM  
COLLOID JOURNAL 64(2), 178-185 (2002)
20. **STRELETSKII, AN; LEONOV, AV; BERESTESKAYA, IV; MUDRETSOVA, SN; MAJOROVA, AF; BUTYAGIN, PJ.**  
AMORPHIZATION AND REACTIVITY OF SILICON INDUCED BY MECHANICAL TREATMENT  
METASTABLE, MECHANICALLY ALLOYED AND NANOCRYSTALLINE MATERIALS 386-3, 187-192 (2002)
21. **BUTYAGIN, PY; STRELETSKII, AN; BERESTETSKAYA, IV; BORUNOVA, AB.**  
AMORPHIZATION OF SILICON DURING MECHANICAL TREATMENT OF ITS POWDERS: 3. SORPTION OF GASES  
COLLOID JOURNAL 63(5), 639-644 (2001)
22. **STRELETSKII, AN; LEONOV, AV; BUTYAGIN, PY.**  
AMORPHIZATION OF SILICON DURING MECHANICAL TREATMENT OF ITS POWDERS: 1. PROCESS KINETICS  
COLLOID JOURNAL 63(5), 630-634 (2001)
23. **STRELETSKII, AN; MUDRETSOVA, SN; MAIOROVA, AF; VAN MILTENBURG, JC; BUTYAGIN, PY.**  
AMORPHIZATION OF SILICON DURING MECHANICAL TREATMENT OF ITS POWDERS: 2. HEATS OF RECRYSTALLIZATION  
COLLOID JOURNAL 63(5), 635-638 (2001)
24. **BUTYAGIN, P.**  
MECHANOCHEMICAL SYNTHESIS: MECHANICAL AND CHEMICAL FACTORS  
JOURNAL OF MATERIALS SYNTHESIS AND PROCESSING 8(3-4), 205-211 (2000)
25. **POVSTUGAR, IV; CHICHERIN, DS; BUTYAGIN, PY; PORTNOI, VK.**  
INITIAL STAGE OF THE DEFORMATIONAL MIXING IN THE FE/TI SYSTEM  
COLLOID JOURNAL 62(3), 367-371 (2000)
26. **KOLBANEV, I. V.; BUTYAGIN, P. YU.; STRELETSKII, A. N.**  
ON THE MECHANOCHEMISTRY OF ALUMINUM  
KHM. FIZ. 19(8), 96 (2000)
27. **BUTYAGIN, P.**  
REHBINDER'S PREDICTIONS AND ADVANCES IN MECHANOCHEMISTRY COLLOIDS AND SURFACES A-PHYSICO-CHEMICAL AND ENGINEERING ASPECTS 160(2), 107-115 (1999)
28. **BUTYAGIN, PY.**  
FORCED REACTIONS IN INORGANIC AND ORGANIC CHEMISTRY  
COLLOID JOURNAL 61(5), 537-544 (1999)
29. **DOROFEEV, GA; KONYGIN, GN; YELSUKOV, EP; POVSTUGAR, IV; STRELETSKII, AN; BUTYAGIN, PY; ULYANOV, AL.**  
FE-5 AND SN-19 MOSSBAUER INVESTIGATION OF KINETICS OF SOLID STATE REACTIONS IN FE68SN32 SYSTEM UNDER MECHANICAL ALLOYING  
IZVESTIYA AKADEMII NAUK SERIYA FIZICHESKAYA 63(7), 1446-1451 (1999)

- 30. DOROFEEV, GA; KONYGIN, GN; YELSUKOV, EP; POVSTUGAR, IV; STRELETSKII, AN; BUTYAGIN, PY; ULYANOV, AL; VORONINA, EV.**  
STRUCTURAL EVOLUTION IN MECHANICALLY ALLOYED FE-SN - FE-57 AND SN-119 MOSSBAUER EFFECT INVESTIGATIONS  
MOSSBAUER SPECTROSCOPY IN MATERIALS SCIENCE 66, 151-160 (1999)
- 31. BUTYAGIN, P. YU..**  
MECHANICAL DISORDERING AND REACTIVITY OF SOLIDS  
RUSS. CHEM. REV 23, 91 (1998)
- 32. BUTYAGIN, PY; STRELETSKII, AN; MOROZOVA, OS; LEONOV, AV; BERESTETSKAYA, IV; BORUNOVA, AB.**  
MECHANICALLY-INDUCED CHEMICAL CONVERSIONS IN A ZR-CO-H-2 SYSTEM. BASIC REACTIONS  
CHEMICAL PHYSICS REPORTS 17(3), 521-542 (1998)
- 33. POPOVA, TG; BUTYAGIN, PY; STRELETSKII, AN; PORTNOI, VK.**  
DYNAMICS OF INTERFACIAL AREA CHANGE DURING MECHANICAL ALLOYING OF W WITH NI  
COLLOID JOURNAL 59(6), 737-741 (1997)
- 34. BUTYAGIN, PY.**  
THE ROLE OF INTERFACES IN THE REACTIONS OF LOW-TEMPERATURE MECHANOCHEMICAL SYNTHESIS  
COLLOID JOURNAL 59(4), 425-431 (1997)
- 35. BUTYAGIN, PY.**  
INTERNATIONAL SYMPOSIUM ON METASTABLE MECHANICALLY ALLOYED AND NANOCRYSTALLINE MATERIALS (ISMANAM-96)  
COLLOID JOURNAL 59(1), 112-122 (1997)
- 36. STRELETSKII, AN; LEONOV, AV; BUTYAGIN, PY.**  
ON THE ROLE OF INTERGRAIN BOUNDARIES IN SOLID/GAS MECHANOCHEMICAL SYNTHESIS.  
SYNTHESIS AND PROPERTIES OF MECHANICALLY ALLOYED AND NANOCRYSTALLINE MATERIALS, PTS 1 AND 2 - ISMANAM-96 235-2, 181-186 (1997)
- 37. STRELETSKII, AN; BUTYAGIN, PY; LEONOV, AV.**  
MECHANOCHEMICAL SOLID-GAS REACTIONS: KINETICS AND PRODUCTS OF INTERACTION BETWEEN ZR AND CO  
COLLOID JOURNAL 58(2), 238-245 (1996)
- 38. STRELETSKII, AN; MOROZOVA, OS; BERESTETSKAYA, IV; BORUNOVA, AB; BUTYAGIN, PJ.**  
MECHANOCHEMICAL REACTIONS IN GAS (H<sub>2</sub>,CO) SOLID (ZR,A-NIZR) SYSTEMS  
METASTABLE, MECHANICALLY ALLOYED AND NANOCRYSTALLINE MATERIALS, PTS 1 AND 2 225, 539-544 (1996)
- 39. BUTYAGIN, PY.**  
RELAXATION OF ATOMIC STRUCTURE ON MECHANICAL TREATMENT OF SOLIDS  
MECHANICALLY ALLOYED AND NANOCRYSTALLINE MATERIALS: ISMANAM-94 179-, 25-31 (1995)
- 40. BUTYAGIN, PY; STRELETSKII, AN; MOROZOVA, OS; BERESTETSKAYA, IV; BORUNOVA, AB.**  
MECHANOCHEMICAL ACTIVATION OF HYDROGEN  
DOKLADY AKADEMII NAUK 336(6), 771-775 (1994)
- 41. BUTYAGIN, PY.**  
PROBLEMS IN MECHANOCHEMISTRY AND PROSPECTS FOR ITS DEVELOPMENT  
RUSS CHEM REV 63, 965 (1994)

- 42. BUTYAGIN, PY.**  
PROSPECTS AND PROBLEMS OF ADVANCE IN MECHANOCHEMISTRY  
USPEKHI KHIMII 63(12), 1031-1043 (1994)
- 43. BUTYAGIN, PY; DUBINSKAYA, AM.**  
THE 1ST INTERNATIONAL-CONFERENCE ON MECHANOCHEMISTRY  
(INCOME)  
COLLOID JOURNAL 56(1), 103-108 (1994)
- 44. BUTYAGIN, P. YU..**  
DEVELOPMENT OF MECHANOCHEMISTRY: PROBLEMS AND PROSPECTS  
USP. CHIM. 63(12), 1031 (1994)
- 45. BUTYAGIN, PY.**  
ON THE CRITICAL-STATE OF SUBSTANCE BY MECHANOCHEMICAL  
PROCESSES  
DOKLADY AKADEMII NAUK 331(3), 311-314 (1993)
- 46. BUTYAGIN, PY; DUBINSKAYA, AM.**  
THE 1ST INTERNATIONAL-CONFERENCE ON MECHANOCHEMISTRY  
RUSSIAN CHEMICAL BULLETIN 42(7), 1276-1280 (1993)
- 47. BUTYAGIN, PY; YUSHCHENKO, VS.**  
THE TEMPERATURE-COEFFICIENT OF THE VELOCITY OF THE SIMPLEST  
SOLID-PHASE REACTION  
DOKLADY AKADEMII NAUK 328(4), 469-472 (1993)
- 48. BUTYAGIN, PY.**  
THE STATE OF SUBSTANCES DURING MECHANICAL TREATMENT  
MECHANICAL ALLOYING FOR STRUCTURAL APPLICATIONS , 385-392  
(1993)
- 49. BUTYAGIN, PJ.**  
THE CHEMICAL FORCES IN MECHANICAL ALLOYING  
MECHANICAL ALLOYING 88, 695-701 (1992)
- 50. BUTYAGIN, PY.**  
ON THE DYNAMICS OF MECHANOCHEMICAL SYNTHESIS  
DOKLADY AKADEMII NAUK SSSR 319(2), 384-388 (1991)
- 51. SHELIMOV, KB; BUTYAGIN, PY.**  
ON THE EXPLOSION MECHANOCHEMICAL SYNTHESIS OF REFRACTORY  
COMPOUNDS  
DOKLADY AKADEMII NAUK SSSR 316(6), 1439-1444 (1991)
- 52. AVVAKUMOV, EG; PYU, BUTYAGIN.**  
PHYSICAL AND CHEMICAL WAYS OF A RELAXATION OF ELASTIC  
ENERGY IN SOLIDS. MECHANOCHEMICAL REACTIONS IN TWO-  
COMPONENT SYSTEMS  
MECHANICAL ALLOYING IN INORGANIC CHEMISTRY , 32 (1991)
- 53. DAVYDKIN, VY; TRUSOV, LI; BUTYAGIN, PY; MOSKVIN, VV;  
KOLBANEV, IV; NOVIKOV, VI; PLOTKIN, SS; AVVAKUMOV, EG.**  
STRUCTURE OF REFRACTORY CARBIDES SYNTHESIZED BY  
MECHANOCHEMICAL METHOD  
MECHANICAL ALLOYING IN INORGANIC CHEMISTRY , 183 (1991)
- 54. RELUSHKO, PF; BERESTETSKAYA, IV; BUTYAGIN, PY; TRUSOV, LI;  
NOVIKOV, VI; NOVAKOVA, AA; MOSKVIN, VV.**  
MECHANOCHEMICAL FUSION OF IRON-TUNGSTEN  
ZHURNAL FIZICHESKOI KHIMII 64(10), 2858-2864 (1990)
- 55. STRELETSKII, AN; LAPSHIN, VI; BERESTETSKAYA, IV; GINDIN, EI;  
IVANCHIKHINA, GE; KOLBANEV, IV; FOKINA, EL; BUTYAGIN, PY.**  
MECHANICAL DISORDERING OF COMPLEX OXIDES WITH THE  
STRUCTURE OF PEROVSKITE  
KINETICS AND CATALYSIS 30(5), 930-935 (1989)

- 56. RELUSHKO, PF; BERESTETSKAYA, IV; TRUSOV, LI; NOVIKOV, VI; BUTYAGIN, PY.**  
KINETICS OF THE MECHANOCHEMICAL SYNTHESIS OF IRON ALUMINIDE  
KINETICS AND CATALYSIS 30(3), 542-547 (1989)
- 57. BUTIAGIN, PI; DAVYDKIN, VI; TRUSOV, LI; KOLBANEV, IV; LAPOVOK, VN; NOVIKOV, VI.**  
KINETIC REGULARITIES OF THE MECHANOCHEMICAL SYNTHESIS OF METAL CARBIDES  
DOKLADY AKADEMII NAUK SSSR 308(2), 405-409 (1989)
- 58. BUTYAGIN, PY; YUSHCHENKO, VS.**  
MOLECULAR-DYNAMICS OF DEFORMATION MIXING IN MIXTURES OF SOLIDS  
KINETICS AND CATALYSIS 29(5), 1085-1088 (1988)
- 59. BUTJAGIN, PJ.**  
ENERGY ASPECTS OF MECHANOCHEMISTRY  
IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR SERIYA KHIMICHESKIKH NAUK (5), 48-59 (1987)
- 60. PAVLYCHEV, IK; BOBYSHEV, AA; BUTYAGIN, PY.**  
DECAY OF DEFORMED SILICON-OXYGEN BONDS UNDER THE ELECTRON-EXCITATION OF MECHANICALLY ACTIVATED SILICON DIOXIDE  
KHIMICHESKAYA FIZIKA 6(2), 188-194 (1987)
- 61. BUTYAGIN, PY.**  
MECHANOCHEMISTRY, CATALYSIS, AND CATALYSTS  
KINETICS AND CATALYSIS 28(1), 1-13 (1987)
- 62. BUTYAGIN, PY; KUZNETSOV, AR; PAVLYCHEV, IK.**  
MINIATURE LABORATORY MILL FOR MECHANOCHEMICAL STUDIES  
INSTRUMENTS AND EXPERIMENTAL TECHNIQUES 29(6), 1464-1467 (1986)
- 63. BUTYAGIN, PY.**  
MECHANOCHEMICAL REACTIONS OF SOLIDS WITH GASES  
REACTIVITY OF SOLIDS 1(4), 345-359 (1986)
- 64. BUTYAGIN, PY; PAVLICHEV, IK.**  
DETERMINATION OF ENERGY YIELD OF MECHANOCHEMICAL REACTIONS  
REACTIVITY OF SOLIDS 1(4), 361-372 (1986)
- 65. PAKOVICH, AB; STRELETSKII, AN; SKUYA, LN; BUTYAGIN, PY.**  
LUMINESCENCE OF SILYLENE CENTERS ON THE MECHANICALLY ACTIVATED SILICON DIOXIDE SURFACE  
KHIMICHESKAYA FIZIKA 5(6), 812-821 (1986)
- 66. BUTYAGIN, PY; BERESTETSKAYA, IV; KOLBANEV, IV; PAVLYCHEV, IK.**  
MECHANIC-CHEMICAL GRAPHITE HYDRATION BY HYDROGEN  
ZHURNAL FIZICHESKOI KHIMII 60(3), 579-584 (1986)
- 67. STRELETSKII, AN; PAKOVICH, AB; BUTYAGIN, PY.**  
STRUCTURAL DEFECTS AND TRIBOLUMINESCENCE EXCITATION IN AMORPHOUS-SILICON DIOXIDE  
IZVESTIYA AKADEMII NAUK SSSR SERIYA FIZICHESKAYA 50(3), 477-482 (1986)
- 68. ABAGYAN, G. V; BUTYAGIN, P.YU.**  
MECHANICALLY INITIATED FREE RADICAL REACTIONS IN POLYSACCHARIDES  
POLYM. SCI. U. S. S. R. , 26 (1984)
- 69. ABAGYAN, GV; BUTYAGIN, PY.**  
MECHANICALLY INITIATED FREE-RADICAL REACTIONS IN POLYSACCHARIDES

VYSOKOMOLEKULYARNYE SOEDINENIYA SERIYA A 26(6), 1311-1317  
(1984)

- 70. BUTYAGIN, PY.**  
STRUCTURE DISORDERING AND MECHANOCHEMICAL REACTIONS IN  
SOLID STATES  
USPEKHI KHIMII 53(11), 1769-1789 (1984)
- 71. BUTYAGIN, PY; BERESTETSKAYA, IV.**  
ADSORPTION OF GASES ON AN MGO FRICTION SURFACE  
KINETICS AND CATALYSIS 24(2), 367-371 (1983)
- 72. BUTYAGIN, PY; BERESTETSKAYA, IV; KOLBANEV, IV.**  
REACTIVITY OF AN MGO FRICTION SURFACE  
KINETICS AND CATALYSIS 24(2), 372-378 (1983)
- 73. BUTYAGIN, GP; BUTYAGIN, PY; SHLYAPINTOKH, VY.**  
LOW-MOLECULAR PRODUCTS OF THE DEGRADATION OF PEROXIDE  
RADICALS IN POLYSTYRENE AND POLYVINYL CYCLOHEXANE AT ROOM-  
TEMPERATURE  
VYSOKOMOLEKULYARNYE SOEDINENIYA SERIYA A 24(1), 165-172 (1982)
- 74. KOLBANEV, IV; BUTYAGIN, PY.**  
MECHANOCHEMICAL REACTIONS OF SILICON WITH WATER  
KINETICS AND CATALYSIS 23(2), 271-277 (1982)
- 75. BUTYAGIN, PY; KOLBANEV, IV.**  
DECOMPOSITION OF WATER ON THE SURFACE OF SILICON SPLITTING  
ZHURNAL FIZICHESKOI KHIMII 55(4), 1092-1092 (1981)
- 76. BERESTETSKAIA, IV; BUTIAGIN, PI.**  
MECHANOCHEMICAL ACTIVATION OF MAGNESIUM-OXIDE SURFACES  
DOKLADY AKADEMII NAUK SSSR 260(2), 361-364 (1981)
- 77. BYSTRIKOV, AV; STRELETSKII, AN; BUTYAGIN, PY.**  
MECHANOCHEMISTRY OF QUARTZ SURFACE .5. OXIDATION OF CARBON-  
MONOXIDE  
KINETICS AND CATALYSIS 21(5), 823-827 (1980)
- 78. BYSTRIKOV, AV; BERESTETSKAYA, IV; STRELETSKII, AN; BUTYAGIN,  
PY.**  
MECHANOCHEMISTRY OF QUARTZ SURFACE .1. PRODUCTS OF REACTION  
WITH HYDROGEN  
KINETICS AND CATALYSIS 21(3), 570-574 (1980)
- 79. STRELETSKII, AN; BUTYAGIN, PY.**  
MECHANOCHEMISTRY OF QUARTZ SURFACE .2. ROLE OF FRICTION  
KINETICS AND CATALYSIS 21(3), 575-580 (1980)
- 80. BYSTRIKOV, AV; STRELETSKII, AN; BUTYAGIN, PY.**  
THE MECHANOCHEMISTRY OF QUARTZ SURFACES .3. ACTIVE-CENTERS  
IN THE REACTION WITH HYDROGEN  
KINETICS AND CATALYSIS 21(4), 739-743 (1980)
- 81. BERESTETSKAYA, IV; BYSTRIKOV, AV; STRELETSKII, AN; BUTYAGIN,  
PY.**  
MECHANOCHEMISTRY OF THE SURFACE OF QUARTZ .4. INTERACTION  
WITH OXYGEN  
KINETICS AND CATALYSIS 21(4), 744-747 (1980)
- 82. KOLBANEV, IV; BERESTETSKAYA, IV; BUTYAGIN, PY.**  
MECHANOCHEMISTRY OF QUARTZ SURFACE .6. PROPERTIES OF  
PEROXIDE =SIOOOSI=  
KINETICS AND CATALYSIS 21(5), 828-832 (1980)
- 83. STRELETSKII, AN; BUTYAGIN, PY.**  
LUMINESCENCE AND ADSORPTION DURING RECONSTRUCTION OF FRESH



- CLEAVAGE SURFACE OF QUARTZ  
DOKLADY AKADEMII NAUK SSSR 225(5), 1118 (1975)
- 84. BUTYAGIN, PY; GARANIN, VV.**  
TRANSITION OF ENERGY COMPONENT OF STRESS INTO ENTROPY  
COMPONENT IN KAPRON  
VYSOKOMOLEKULYARNYE SOEDINENIYA SERIYA A 16(2), 327 (1974)
- 85. BUTYAGIN, PY.**  
CELL-SIZE IN BIMOLECULAR REACTIONS IN SOLID POLYMERS  
VYSOKOMOLEKULYARNYE SOEDINENIYA SERIYA A 16(1), 63 (1974)
- 86. KOLBANEV, IV; BUTYAGIN, PY.**  
ELECTRON-PARAMAGNETIC RESONANCE METHOD FOR STUDY OF  
MECHANICAL-CHEMICAL REACTIONS WITH PARTICIPATION OF QUARTZ  
ZHURNAL FIZICHESKOI KHIMII 48(5), 1158 (1974)
- 87. BUTYAGIN, PY; GARANIN, VV; KUZNETSO, AR.**  
POSSIBILITIES OF THERMAL (INFRARED) RADIATION RECORDING  
METHOD FOR INVESTIGATION OF NATURE OF STRESSES IN POLYMERS  
VYSOKOMOLEKULYARNYE SOEDINENIYA SERIYA A 16(2), 333 (1974)
- 88. DUBINSKA, AM; BUTYAGIN, PY.**  
TUNNEL EFFECT IN  $H+RH=R+H_2$  REACTIONS AT 100-150 DEGREES K  
DOKLADY AKADEMII NAUK SSSR 211(1), 141 (1973)
- 89. STRELETS, AN; BUTYAGIN, PY.**  
NATURE OF LUMINESCENCE OBSERVED DURING DEFORMATION,  
BREAKING AND FRICTION OF POLYMERS  
VYSOKOMOLEKULYARNYE SOEDINENIYA SERIYA A 15(3), 654 (1973)
- 90. BUTYAGIN, P. YU.; RADZIG, W. A..**  
MECHANOCHEMISCHE UMWANDLUNGEN IN POLYMEREN  
PLASTE KAUTSCH 19(2), 81 (1972)
- 91. YARYMAGA, YN; BUTYAGIN, PY.**  
SHORT-LIVED ACTIVE CENTERS IN HETEROGENEOUS  
MECHANOCHEMICAL REACTIONS  
DOKLADY AKADEMII NAUK SSSR 207(4), 892 (1972)
- 92. BUTYAGIN, P. Y..**  
KINETICS AND NATURE OF MECHANOCHEMICAL REACTIONS  
RUSSIAN CHEMICAL REVIEWS 40, 905 (1971)
- 93. BOROVKOV, VY; BUTYAGIN, PY.**  
NATURE AND PROPERTIES OF ACTIVE CENTRES FORMED DURING  
MECHANICAL DESTRUCTION OF SOME SOLIDS  
DOKLADY AKADEMII NAUK SSSR 198(3), 618 (1971)
- 94. BUTYAGIN, P. YU..**  
KINETICS AND NATURE OF MECHANOCHEMICAL REACTIONS  
SUCCESSES OF CHEMISTRY 40, 1935 (1971)
- 95. BUTYAGIN, PY; EROFEEV, VS; MUSAELYA, IN; PATRIKKEE, GA;  
STRELETS, AN; SHULYAK, AD.**  
ABOUT LUMINESCENCE ACCOMPANIED MECHANICAL DEFORMATION  
AND RAPTURE OF POLYMERS  
VYSOKOMOLEKULYARNYE SOEDINENIYA SECTION A 12(2), 290 (1970)
- 96. BUTYAGIN, PY; DUBINSKAYA, MA; RADTSIG, AV.**  
ELECTRON SPIN RESONANCE SPECTRA, CONFORMATION, AND  
CHEMICAL PROPERTIES OF FREE RADICALS IN SOLID POLYMERS  
RUSS CHEM REV 38(4), 290 (1969)
- 97. BUTYAGIN, P. YU.; KOLBANEV, I. V.; DUBINSKAYA, A. M.; KISLUK, M. U..**  
ABOUT PRIMARY RADICAL STAGES OF LOW TEMPERATURE OXIDATION  
OF POLYMERS  
VYSOKOMOLEKULYARNYE SOEDINENIYA, SERIYA A 10(10), (1968)

- 98. ABAGYAN, G. V.; KRUTOVA, YU. N.; PUTILOVA, I. N.; BUTYAGIN, P. YU..**  
ISSLEDOVANIE SVOBODNYKH RADIKALOV V [GAMMA]-OBLUCHENNOM  
KRAKH-MALE METODOM ELEKTRONNOGO PARAMAGNITNOGO  
REZONANSA  
BIOFIZIKA 12((5)), 820 (1967)
- 99. ABAGYAN, G. V.; BUTYAGIN, P. YU..**  
SPEKTRY ELEKTRONNOGO PARAMAGNITNOGO REZONANSA,  
NABLYUDAEMYE PRI MEKHANICHESKOI OBRABOTKE PREPARATOV DNK  
BIOFIZIKA 10((5)), 763 (1965)
- 100. BUTYAGIN, PY.**  
REACTION MECHANISM OF FREE RADICALS DECAY IN  
POLYMETHYLMETACRYLATE  
DOKLADY AKADEMII NAUK SSSR 165(1), 103 (1965)
- 101. BUTYAGIN, P.YU.; DROZDOVSKII, V.F.; RAZGON, D.R.; KOLBANEV,  
I.V..**  
EPR SPECTRA OF FREE RADICALS ARISING IN THE MECHANICAL  
BREAKDOWN OF POLYMERS. VULCANIZED RUBBERS  
FIZIKA TVERDOGO TELA 7(3), (1965)
- 102. ABAGYAN, G. V.; P.; BUTYAGIN, YU..**  
ISSLEDOVANIE MEKHANICHESKOI DESTRUKTSII ZHELATINY METODOM  
ELEKTRONNOGO PARAMAGNITNOGO REZONANSA  
BIOFIZIKA 9((2)), 180 (1964)
- 103. ABAGYAN, GV; BUTYAGIN, PY.**  
SEQUENCE OF FREE-RADICAL REACTION WHEN PROTEIN MOLECULES  
ARE ACTED UPON MECHANICALLY  
DOKLADY AKADEMII NAUK SSSR 154(6), 1444 (1964)
- 104. BUTYAGIN, PY; KOLBANEV, IV; RADTSIG, VA.**  
ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF FREE RADICALS IN  
THE DESTRUCTION PRODUCTS OF SOLID POLYMERS  
SOVIET PHYSICS-SOLID STATE 5(8), 1642 (1964)
- 105. BUTYAGIN, P.Y.; KOLBANOV, I.V.; RADTSIG, V.A..**  
ELECTRON PARAMAGNETIC SPECTRA OF FREE RADICALS IN THE  
PRODUCTS OF FRACTURE OF SOLID POLYMERS  
FIZIKA TVERDOGO TELA 5(8), (1963)
- 106. ULBERT, K; BUTIAGIN, PI.**  
ELECTRON SPIN RESONANCE SPECTRA ARISING AFTER MECHANIC AND  
THERMAL PROCESSING OF NATURAL CISTIN CONTAINING POLYMERS  
DOKLADY AKADEMII NAUK SSSR 149(5), 1194 (1963)
- 107. BUTYAGIN, PY.**  
ACTIVE INTERMEDIATE STATES IN MECHANICAL BREAKDOWN OF  
POLYMERES  
DOKLADY AKADEMII NAUK SSSR 140(1), 145 (1961)