Information

Russian-language chemical information in Chemical Abstracts Service and VINITI

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The flow of Russian-language chemical information of 1997 in the *Chemical Abstracts* (CA) database (DB) and in the corresponding parts of the multi-subject database of the Russian Institute for Scientific and Technical Information (VINITI) is analyzed. The CA coverage corresponds to not only the "Khimiya" (Chemistry) DB but also, fully or partly, to at least six other VINITI DBs. The total array of the Russian-language documents in these DBs exceeds that in the CA array almost twofold, even taking into account the possible overlap. This is due to the limited-circulation ("gray") literature and nonspecialized journals. The distribution of Russian-language publications among the CA parts and sections is mapped. Their ranking shows that applied works are presented most fully in CA, some sections of organic and physical chemistry are presented at a level higher than the average level, and the biochemical part of the Russian-language document flow appears to be presented most poorly.

Key words: chemical information, Russian-language publications, *Chemical Abstracts*, VINITI, databases.

Each chemist is a reader of scientific and technical literature. The best way to find what is to be read (because the whole body of information cannot be embraced) is to use a search system, which can be either printed (abstracts journals with indexes) or electronic (databases). Databases (DBs) are usually created based on abstracts journals and differ from the latter by greater search possibilities, while the content remains the same. It is fairly difficult to select the optimum information system; however, it is clear that completeness of the coverage of the subject considered in the system is a significant criterion. The *Chemical Abstracts* (CA) database produced by the Chemical Abstracts Service (CAS) and used most frequently both in Russia and all over the world is supplemented annually by about 700,000 documents.[1] For the multi-subject DB system of the Russian Institute for Scientific and Technical Information (VINITI), this gain is about a million publications a year.[2]

It is clear that the national literature is covered more fully in national information centers than in foreign

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Table 1. Distribution of the Russian-language document flow of 1997 over the main types of original sources in the ChemCluster and CA databases

Database	Journal articles		Papers from combined works (Proceedings)		Books		Deposited manuscripts		Patent documents		Overall flow, number
	number	fraction(%)	number	fraction(%)	number	fraction(%)	number	fraction(%)	number	fraction(%)	
"Chemistry"	18224	53.7	7616	22.4	292	0.9	939	2.8	6878	20.2	33949
"Corrosion"	985	46.9	438	20.9	33	1.6	87	4.1	556	26.5	2099
"PCB"	2862	66.4	907	21.0	37	0.9	126	2.9	377	8.8	4311
"Metallurgy"*	3833	82.1	125	2.7	55	1.2	225	4.8	432	9.2	4670
"Physics"*	7542	90.2	618	7.4	59	0.7	126	1.5	16	0.2	8361
"Geology"*	1658	56.9	1125	38.6	58	2.0	53	1.8	19	0.7	2913
"Mining"*	715	55.3	326	25.2	18	1.4	57	4.4	177	13.7	1293
ChemCluster	35819	62.1	11155	19.4	552	1.0	1613	2.8	8455	14.7	57596
CA	19945	74.1	148	0.6	25	0.1	—	—	6782	25.2	26902

*Parts of the DB having analogs in CA.

thematic analogs.[3] However, comparative analysis of the CA database and the "Khimiya" (Chemistry) database of VINITI (and/or the corresponding abstracts journals) was carried out by Russian and American specialists only in 1971—1989.[4—7] The report on this topic presented recently at a conference[8] dealt with a fairly narrow chemical subject matter. Since the situation in Russian science changed dramatically in the 1990s, it appears now quite opportune to perform an analysis of this type.

The purpose of this study is to elucidate how Russian-language publications and journals whose scope is around chemistry are reflected in the overlapping parts of the CA and VINITI systems. On the one hand, these data would help specialists in choosing sources of information concerning the research done by Russian colleagues. On the other hand, it would permit an objective estimate of the position of the near-chemistry fields of Russian science in the world research and reveal the priority lines of research formed in Russia.

Analysis of the distribution of documents over topics shows that the chemistry subject matter, as it is covered in CA, is spread over several DBs included in the VINITI system. The greatest extent of coincidence in the subject matter between sections of the CAS Classification index[9] and the list of classification headings (Rubricator) of the VINITI[10] is found for three main VINITI DBs closest to chemistry, namely, "Khimiya" (Chemistry), "Korroziya i zashchita ot korrozii" (Corrosion and Corrosion Protection), and "Fiziko-khimicheskaya biologiya" (Physicochemical Biology (PCB)) and for some headings of the "Metallurgiya" (Metallurgy), "Geologiya" (Geology), "Gornoe Delo" (Mining), and "Fizika" (Physics) DBs. Below this array of fragments of the VINITI DB system is referred to as ChemCluster. A substantially smaller number of Russian-language publications not included in the ChemCluster can also be found in the "Avtomatika i Radioelektronika" (Automation and Radioelectronics), "Biologiya" (Biology), "Energetika" (Power Engineering), and some other DBs.

The convenience for a user and the economical aspect are beyond the scope of this study. However, one cannot but admit that working with CAS requires subscription to only one CA journal or one DB, while to work with VINITI system, one should subscribe to a whole series of abstracts journals or DBs. Remote access to the abstracts (but not structural formulas) of the VINITI DBs is only possible for the period from 1997 up to the previous month of the current year, whereas in the CA/REGISTRY* DB tandem, the accessible data array includes abstracts and structures starting from 1967 up to the last week (CAplus and REGISTRY are updated daily and CAold contains information for 1907—1966; however, the search facilities for this period are restricted).

The results of comparison based on the data for 1997 are presented in Table 1. It should be noted that each abstract appears in only one section in CA, whereas in the VINITI system, duplication of publications in different DBs is allowed. According to our selective estimates, the degree of duplication in ChemCluster amounts to ~15%.

A specific feature of ChemCluster flow of publications is a substantial proportion of deposited scientific documents (2.8%) and the absence of accounts. Conversely, the CAS stopped reflecting deposited papers since 1985 but has 0.01% of research reports. It can be seen from Table 1 that ChemCluster includes 1.9 times more (with allowance for the 15% duplication) Russian-language publications than the CA DB. The document flow that is common for the two DBs includes mainly journal articles and patents.

*The CAS DB system gives information on the structural formulas of substances in the REGISTRY, and the subject information on these substances is given in CA.

The difference between the structures of the flows is due to the facts that the ChemCluster

— reflects a large body of "gray" literature, namely, deposited manuscripts, proceedings of conferences and scientific sessions, collections of works of scientific and engineering centers, libraries, *etc.*, which accounts altogether for 22% of the publications; in CA, this type of Russian-language publications is covered slightly (0.6%);

— covers 20 times more items of the books that are published these days in limited circulations by numerous publishers in Russia and in the C.I.S. and hardly get to the Western countries (the number of these books is modest in the total array of data but their ratio is rather notable);

— covers much more journals published in Russian.

Indeed, the array of journals that publish papers in Russian and are covered in the systems being compared comprises 321 journal in CA and 895 journals in ChemCluster (without taking account of the Mining and Geology DBs) (Table 2). For each fragment considered, we have found the numbers of the most productive (*i.e.*, covering 30% of the total number of papers), specialized (60% of papers), and nonspecialized (the remaining 40% of papers) journals. In each fragment, monothematic journals (*i.e.*, those covering only the subject matter of this fragment) were distinguished. It can be seen from Table 2 that this type of journals accounts for about 50% of the whole array of journals. The second part of journals are multitopic journals, which publish papers corresponding to two or more fragments. Therefore, the numbers of journals characterizing the ChemCluster in each column of Table 2 is not necessarily equal to the sum of the numbers in the row "total." Journals with a productivity of 9 or less papers a year account for 471 out of the 895 items in the Russian-language array of the ChemCluster, while for CA, this value is 53 out of 321.

The ranked frequency list of the most productive journals reflected in the CA DB and in the five above-mentioned ChemCluster fragments is in fairly good agreement for the two arrays being compared:

1. *Doklady AN* [*Dokl. Chem.* (*or Phys. Chem.*) (Engl. Transl.)]
2. *Fizika Tverdogo Tela* [*Solid-State Physics* (Engl. Transl.)]
3. *Izvestiya AN. Seriya Fizicheskaya* [*Bull. Russ. Acad. Sci. Physics* (Engl. Transl.)]
4. *Zhurnal Prikladnoi Khimii* [*J. Appl. Chem.* (Engl. Transl.)]
5. *Vysokomolekulyarnye Soedineniya. Series A and B* [*Polym. Sci., Ser. A and B* (Engl. Transl.)]
6. *Izvestiya AN. Seriya Khimicheskaya* [*Russ. Chem. Bull.* (*Engl. Transl.*)]
7. *Zhurnal Obshchei Khimii* [*Russ. J. Gen. Chem.* (Engl. Transl.)]
8. *Zhurnal Neorganicheskoi Khimii* [*Russ. J. Inorg. Chem.* (Engl. Transl.)]
9. *Optika i Spektroskopiya* [*Optics and Spectroscopy* (Engl. Transl.)]
10. *Fizika Metallov i Metallovedenie* [*Physics of Metals and Physical Metallurgy* (Engl. Transl.)]
11. *Izvestiya VUZov. Chernaya Metallurgiya* [*Higher School Bull. Ferrous Metallurgy* (Engl. Transl.)]
12. *Stal'* [*Steel* (Engl. Transl.)]
13. *Yadernaya Fizika* [*Nuclear Physics* (Engl. Transl.)]
14. *Zhurnal Organicheskoi Khimii* [*Russ. J. Org. Chem.* (Engl. Transl.)]
15. *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* [*JETP Letters* (Engl. Transl.)]
16. *Zhurnal Fizicheskoi Khimii* [*Russ. J. Phys. Chem.* (Engl. Transl.)]
17. *Fizika Nizkikh Temperatur (Ukraina)* [*Low-Temperature Physics (Ukraine)*]
18. *Tsvetnye Metally* [*Nonferrous Metals* (Engl. Transl.)]
19. *Ukrainskii Khimicheskii Zhurnal (Ukraina)* [*Ukrainian Chemistry J.*]
20. *Izvestiya VUZov. Khimiya i Khimicheskaya Tekhnologiya* [*Higher School Bull. Chemistry and Chemical Technology* (Engl. Transl.)]
21. *Khimiya i Tekhnologiya Vody* [*Chem. and Techn. of Water*]
22. *Plasticheskie Massy* [*Plastics* (Engl. Transl.)]
23. *Fizika i Tekhnika Poluprovodnikov* [*Physics and Practice of Semiconductors* (Engl. Transl.)]
24. *Khimicheskaya Fizika* [*Chem. Phys.* (Engl. Transl.)]
25. *Bioorganicheskaya Khimiya* [*Bioorg. Chem.* (Engl. Transl.)]
26. *Kvantovaya elektronika* [*Quantum Electronics* (Engl. Transl.)]
27. *Koordinatsionnaya Khimiya* [*Coord. Chem.* (Engl. Transl.)]
28. *Khimicheskaya Promyshlennost'* [*Chem. Ind.* (Engl. Transl.)]
29. *Gornyi Zhurnal* [*Mining J.*]
30. *Antibiotiki i Khiminioterapiya* [*Antibiotics and Chemotherapy* (Engl. Transl.)]
31. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* [*J. Exp. Theor. Phys.* (Engl. Transl.)]
32. *Opticheskii Zhurnal* [*Optical J.* (Engl. Transl.)]

Table 2. Distribution of journals over the fragments of ChemCluster

Fragment	Total number	Monothematic	Most productive	Specialized
"Chemistry"	521	204	16	50
"Corrosion"	167	13	5	26
"PCB"	255	139	6	17
"Metallurgy"	171	22	5	14
"Physics"	254	50	11	37
Total	895	428	35	113

Table 3. Distribution of the overall and Russian-language flows of publications over the main CA parts

Part	Overall flow of publications		Russian-language publications	
	number	fraction (%)	number	fraction (%)
Biochemistry	256242	35.9	3785	1.48
Organic chemistry	40805	5.7	1792	4.39
Macromolecular chemistry	66299	9.3	2562	3.86
Applied chemistry and chemical technology	162356	22.7	9155	5.64
Physical, inorganic, and analytical chemistry	187839	26.3	6867	3.65
Total	713541	100	24161	3.39

Table 4. Distribution of the overall and Russian-language flows of publications over CA sections

Section number	Section heading	Total number of publications	Russian-language publications: number	Russian-language publications: fraction (%)
54	Extractive Metallurgy	4135	800	19.4
53	Mineralogical and Geological Chemistry	9550	1285	13.5
49	Industrial Inorganic Chemicals	3952	534	13.5
23	Aliphatic Compounds	1693	217	12.8
47	Apparatus and Plant Equipment	4253	504	11.9
51	Fossil Fuels, Derivatives, and Related Products	12167	1364	11.2
55	Ferrous Metals and Alloys	13158	1432	10.9
58	Cement, Concrete, and Related Building Materials	4882	500	10.2
69	Thermodynamics, Thermochemistry, and Thermal Properties	1442	140	9.7
44	Industrial Carbohydrates	1016	90	8.86
45	Industrial Organic Chemicals, Leather, Fats, and Waxes	2408	210	8.72
68	Phase Equilibriums, Chemical Equilibriums, and Solutions	2618	228	8.7
50	Propellants and Explosives	1722	135	7.8
25	Benzene, Its Derivatives, and Condensed Benzenoid Compounds	3584	264	7.37
39	Synthetic Elastomers and Natural Rubber	3590	264	7.35
67	Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms	3721	268	7.2
32	Steroids	514	37	7.2
56	Nonferrous Metals and Alloys	20179	1430	7.1
72	Electrochemistry	5431	327	6.0
43	Cellulose, Lignin, Paper, and Other Wood Products	4395	252	5.73
48	Unit Operations and Processes	11624	652	5.6
28	Heterocyclic Compounds (More Than One Hetero Atom)	5212	287	5.51
27	Heterocyclic Compounds (One Hetero Atom)	3356	176	5.24
71	Nuclear Technology	13792	630	4.6
59	Air Pollution and Industrial Hygiene	13107	581	4.43
41	Dyes, Organic Pigments, Fluorescent Brighteners, and Photographic Sensitizers	801	35	4.37
8	Radiation Biochemistry	4590	196	4.27
57	Ceramics	14251	592	4.2
78	Inorganic Chemicals and Reactions	6820	286	4.2
24	Alicyclic Compounds	804	34	4.2
75	Crystallography and Liquid Crystals	11449	475	4.2
61	Water	12791	531	4.15
22	Physical Organic Chemistry	6931	284	4.1
77	Magnetic Phenomena	9952	373	4.0
65	General Physical Chemistry	10865	429	3.95
19	Fertilizers, Soils, and Plant Nutrition	5069	200	3.95
36	Physical Properties of Synthetic High Polymers	5984	236	3.94
62	Essential Oils and Cosmetics	3274	128	3.91
35	Chemistry of Synthetic High Polymers	8289	323	3.9
16	Fermentation and Bioindustrial Biochemistry	3872	150	3.87
73	Optical, Electron, and Mass Spectroscopy and Other Related Properties	32530	1188	3.7
70	Nuclear Phenomena	14591	525	3.6
37	Plastics Manufacture and Processing	12199	426	3.49
79	Inorganic Analytical Chemistry	6773	234	3.46
63	Pharmaceuticals	12441	425	3.42
64	Pharmaceutical Analysis	1804	61	3.38
42	Coatings, Inks, and Related Products	6683	224	3.35
60	Waste Treatment and Disposal	10570	352	3.33
80	Organic Analytical Chemistry	2721	90	3.3
30	Terpenes and Terpenoids	1170	37	3.16
29	Organometallic and Organometalloid Compounds	5819	180	3.1
40	Textiles and Fibers	4227	129	3.05
76	Electric Phenomena	41779	1245	3.0
20	History, Education, and Documentation	3014	89	2.95
10	Microbial, Algal, and Fungal Biochemistry	10801	308	2.85
34	Amino Acids, Peptides, and Proteins	3397	96	2.83
52	Electrochemical, Radiational, and Thermal Energy Technology	8496	234	2.75

(*to be continued*)

Table 4. (*continued*)

Section number	Section heading	Total number of publications	Russian-language publications	
			number	fraction (%)
66	Surface Chemistry and Colloids	8312	227	2.73
5	Agrochemical Bioregulators	4731	129	2.73
17	Food and Feed Chemistry	12209	312	2.56
46	Surface-Active Agents and Detergents	2251	52	2.31
33	Carbohydrates	3784	88	2.3
9	Biochemical Methods	13215	300	2.27
38	Plastics Fabrication and Uses	14456	321	2.22
31	Alkaloids	743	16	2.15
26	Biomolecules and Their Synthetic Analogs	1992	41	2.06
21	General Organic Chemistry	1806	35	1.94
1	Pharmacology	3581	673	1.88
11	Plant Biochemistry	11596	205	1.77
6	General Biochemistry	12091	168	1.39
74	Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes	15743	202	1.3
4	Toxicology	13365	173	1.29
7	Enzymes	12611	155	1.23
13	Mammalian Biochemistry	17252	181	1.1
12	Nonmammalian Biochemistry	7071	57	0.81
2	Mammalian Hormones	21859	159	0.73
15	Immunochemistry	21191	146	0.69
3	Biochemical Genetics	23470	141	0.6
18	Animal Nutrition	5674	31	0.55
14	Mammalian Pathological Biochemistry	19754	101	0.51

Two of these 32 journals are published in Ukraine, the other journals are published in Russia. It is surprising that CA does not cover fully the prestigious journals such as *Khimiya Geterotsiklicheskikh Soedinenii* [*Chem. Heterocycl. Compd.* (Engl. Transl.))] (the 65th position) and *Khimiya Prirodnykh Soedinenii* [*Chem. Nat. Compd.* (Engl. Transl.)] (the 91st position), which are represented in ChemCluster by a much greater number of publications.

The timeliness of reflection of Russian-language publications of 1997 are virtually equal in both DBs; ~34% of entries in ChemCluster and ~33% of entries in CA are current-year publications; ~61 and 58%, respectively, are documents of 1996, and 5% and 8% are works dated 1995. The CA DB contains as well ~1% of publications dated 1994. Analysis of the observed distribution of the publication flow and estimation of the proportion of Russian-language publications in the overall flow in five parts (Table 3) and 80 sections (Table 4) that make up the CAS Classification index[9] allows one to derive some interesting data on the priority lines of research in Russia and the former-USSR countries where papers in Russian are published.

Note that the overall fraction of Russian-language journal publications in CA, which was 22.4% in 1972 and 16% in 1984, constantly decreases. In 1997, it was as low as 3.4%; this corresponds to the fourth place after publications in English, Japanese, and Chinese.[1] This value can be accepted as a reference point for comparison with the data listed in Tables 3 and 4, although it refers only to journal papers rather than to the total number of publications, which is presented in the tables. In 1998, the number of Russian-language papers covered by CA diminished from 20,500 to 17,300, which amounted to 3.1%. However, the number of publications giving an author's address in Russia (irrespective of the language in which the paper is written) remained the same (26,300), and their fraction even increased from 4.5% in 1997 to 4.7% in 1998 because the total number of papers decreased somewhat in 1998.[11]

The pattern of distribution of Russian-language publications over rather narrow topics corresponding to the CA sections implies that Russian-language publications are covered mainly in the parts and sections dealing with applied research. First of all, this refers to sections associated with investigation and industrial processing of mineral resources (sections 54, 53, and 51), metallurgy, chemical technology, and chemical industry (sections 44, 45, 49, 47, 55, 58, and 56). The coverage found for some sections dealing with organic (sections 23, 25, 32, 28, 27, 24, and 22) and physical (sections 69, 68, 67, 72, 75, 77, and 65) chemistry is also above the average level. The fraction of Russian-language publications in most of the biochemical sections is <1.5% (sections 6, 4, 7, 13, 12, 2, 15, 18, 14, 3).

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The 1999 Nobel Prize in Chemistry

The 1999 Nobel Prize in Chemistry was awarded to Prof. *Ahmed Zewail* (California Institute of Technology, Pasadena, USA) for research into transition states of chemical reactions by femtosecond spectroscopy.

Ahmed Zewail was born in 1946 in Egypt. He attended the University of Alexandria (Egypt) and obtained his Doctor of Science degree at the University of Pennsylvania (Philadelphia, USA) in 1974. At present, he works at the California Institute of Technology in Pasadena.

The most advanced laser technology allows generation of light pulses with a duration of tens of femtoseconds, which corresponds to the characteristic times of vibrations of atoms in a molecule and, hence, to the minimum time of a chemical reaction. In his experiments, A. Zewail used reactants in molecular beams and exposed them to two consecutive supershort pulses. The first one (pumping pulse) initiates the reaction by transferring the molecules in the excited state. The second weaker pulse (probing pulse) serves for spectroscopic measurements. By changing the delay between the pulses and the wavelength, one can observe all steps of a chemical reaction.

In the first experiments using this procedure, A. Zewail studied the intermediate states in the reactions ICN $\rightarrow$ I + CN and NaI $\rightarrow$ Na + I. He also studied bimolecular reactions, specifically H + CO_2 $\rightarrow$ CO + OH, and demonstrated that it proceeds *via* the formation of a long-lived (1000 fs) intermediate state, HOCO.

Studies by A. Zewail dealing with dissociation of tetrafluorodiiodoethane $CI_2F_4 \rightarrow C_2F_4 + 2$ I are highly important. He has demonstrated that the iodine atoms are eliminated successively with an interval of ~2000 fs rather than simultaneously. Dissociation of cyclobutane was also found to follow a two-step mechanism.

When investigating the reaction of benzene with diiodine, A. Zewail discovered that the pumping pulse shifts one electron in the benzene molecule to an excited state, then the electron passes to the iodine molecule, which thus becomes negatively charged, while the benzene molecule acquires a positive charge. The electrostatic attraction between the positively charged benzene molecule and the closest negatively charged iodine atom results in "stretching" of the I—I bond, which is then cleaved within 750 fs. Recent studies carried out by A. Zewail have been concerned with complexes of diethyl sulfide with iodine; he observed similar electron transfer and return processes and measured the lifetimes of the intermediate states.

A. Zewail obtained interesting results concerning *cis—trans* isomerization of stilbene. It was shown that after the pumping pulse, the C=C double bond is weakened to such an extent that the benzene rings rotate synchronously by 90°.

Nowadays, Zewail's method is used all over the world. It provides understanding of the mechanisms of dissolution and reactions of solutes and permits the development of new polymeric materials used in electronics. Femtochemistry is widely used in the study of biological systems.

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