

**GLOBAL INFORMATION PROCESS IN THE FIELD OF ELECTROCHEMISTRY
AND MOLDAVIAN ELECTROCHEMICAL SCHOOL.
SCIENCEMETRIC ANALYSIS**

A.I. Dikusar

*Institute of Applied Physics, Academy of Science of Moldova
5 Academiei str., MD – 2028, Kishinev, Moldova*

Abstract

We demonstrated a contribution made by Moldavian scientist to electrochemistry and determined on the basis of results of sciencemetric analysis of papers published in journals, which has been analyzed by SCI in section “Electrochemistry” for 1999 – 2002 years. The role of different scientific institutions and investigation groups is shown. The data on contribution dynamics and informational channels (journals), on which this contribution is realized, are given. Refs. 4, tabs. 5.

The Moldavian electrochemical school was formed in the second half of the 20th century. Its development is associated with the names of such known electrochemists, as A.I. Shlygin (the first head of physical chemistry department of the Kishinev State University), J.I. Turian (physical chemistry department of the Kishinev State University), academicians of the Academy of Science of the MSSR – Yu.S. Lialikov (electroanalytical chemistry) and Yu.N. Petrov (applied electrochemistry and electrochemical technologies).

Electrochemical researches in Moldova have been developed in many directions, among which are electroanalytical chemistry, electrochemistry of complex compounds, galvanotechnics and surface treatment, corrosion, electrochemical machining and micromachining, electroflotation, electrochemical processes in low-conductive liquids, electrochemical information sensors and etc.

These researches were carried out in the Kishinev (later Moldavian) State University, the Institute of Chemistry of AS MSSR, Institute of Applied Physics of the ASM, the Kishinev Polytechnical Institute (later Technical University of Moldova), the Kishinev Agricultural Institute (later Agrarian University). The international scientific and technological journal «Elektronnaya obrabotka materialov» helped electrochemical researchers, having different profile, to join up. The journal has issued by the Institute of Applied Physics of the ASM since 1965. It is also translated in the USA (at first with the title «Applied Electrical Phenomena», after 1983 with the title «Soviet Surface Engineering and Applied Electrochemistry», and after 1992 – «Surface Engineering and Applied Electrochemistry»).

The results of sciencemetric analysis of global information streams in the field of electrochemistry in 1999 – 2002 according to the data of SCI (Science Citation Index), JCR (Journal Citation Reports) are presented in [1]. The obtained results of distribution of contribution of researchers from various countries to the global information process in the field of electrochemistry may form a basis for the analysis of a place of researchers from Moldova in this process, and also they may demonstrate the dynamics of contribution parameters.

It is shown in [1, 2] that data of SCI and JCR are the reliable indicator of a development level of researches in the given country, region, etc.

The results submitted in tab. 1 show a place of Moldova in the global information process in the field of electrochemistry in 1999 – 2002. The share from total number of articles analyzed by JCR in section «Electrochemistry» is one of the main parameters of the

analysis. Average value of this parameter ($0,14 \pm 0,07$ %) for this period is some times higher, than one for Moldova in all sciences (0,024 % for 1994 [3]). It is necessary to take into account, however, essential decrease of parameters in time and a low level of publications in three leading electrochemical journals (J. Electrochemical Society, J. Electroanalytical Chemistry, *Electrochimica Acta*).

The average values of parameter of relative (per capita) contribution of electrochemists from different countries for 1999 and 2002 are presented in tab. 2. If the parameter of SDC (scientific development coefficient) is more than 1, then the contribution of researchers from the given country can be considered as a high level contribution [4]. At $0,1 < \text{SDC} < 1$ the level contribution is average, and at $\text{SDC} < 0,1$ the level is low. The data in tab. 2 demonstrate that Moldavian researchers are reckoned among researchers from ~ 40 countries, having the high level contribution in the field of electrochemistry. This parameter ($2,0 \pm 1,0$) is approximately ten times higher than the same parameter for Moldova in all sciences (0,22) [4].

Researches in the field of electrochemistry, which correspond to a level of the journals analyzed by SCI, are carried out in various scientific institutes of the Republic, from which Technical University of Moldova and Institute of Applied Physics of ASM play the leading part (tab. 3).

The journals analyzed by JCR, in which articles of the Moldavian electrochemists have been published for 1999 – 2002, are submitted in tab. 4. Approximately 90 % of articles have been published in such journals as «Sensors and Actuators B: Chemical» and «Электрохимия» («Russian Journal of Electrochemistry»).

The analysis of articles published in these journals shows, that ~ 70 % of works are independent works performed only by electrochemists of Moldova, and ~ 30 % were realized within the framework of the international cooperation. It is clear that parameters are close to optimum: on the one hand, they testify to participation of the Moldavian researchers in the international division of labour; on the other hand, they demonstrate that the existing personnel potential and the experimental equipment allow to carry out researches at a level, which provides a participation in the global information process. Obviously, researches in such directions as modern sensors and actuators of the information, electrochemical micro- and nanomachining, electrochemical technologies in electronic industry and others, which are characteristic of a modern level of electrochemistry development, are successfully carried out in Moldova as well, alongside with traditional directions of electrochemical science.

It is necessary to note, that publications about these researches are not limited only by the journals analyzed by SCI and JCR. Many other journals publish such kind of researches, and among them the journal «Elektronnaya obrabotka materialov» issued by the Institute of Applied Physics of ASM plays an important part for electrochemists of Moldova.

The results of information stream distribution from researchers of the countries, whose publications took place in 2002 and 2003 in the journal «Elektronnaya obrabotka materialov» are given in tab. 5.

It is seen that the journal, in essence, became international. Researchers from 15 countries published results of their researches in 2003 on pages of this journal, and ~ 25 % of articles were published by researchers from Moldova.

Obviously, that by the end of the 20th century and in the beginning of the 21st century moldavian electrochemical school has taken a worthy place in the global information process and, despite all difficulties of the modern period, continues to develop.

The author expresses his thanks to V.I. Petrenko, O.O. Redcozubova and S.P. Yuschenko for cooperation at performance of the present work.

Table 1.

Information streams distribution in the field of electrochemistry for 1999 – 2002

Nr.	Country	Share from total number of articles, %			Nr.	Country	Share from total number of articles, %		
		1999	2002	1999 – 2002*			1999	2002	1999 – 2002*
1	Japan	17.9	17.3	16.0	36	Mexico	0.26	0.67	0.48
2	USA	17.5	17.3	20.0	37	Bulgaria	0.22	0.56	0.25
3	France	8.10	5.55	7.59	38	Denmark	0.21	0.35	0.44
4	Russia	6.76	5.57	1.19	39	Moldova	0.21	0.07	0.01
5	Germany	5.85	4.75	5.18	40	Estonia	0.20	0.13	0.30
6	South Korea	3.91	6.41	5.29	41	Slovenia	0.19	0.13	0,20
7	United Kingdom	3.63	4.35	3.65	42	Slovakia	0.18	0.04	0,06
8	China	3.58	4.84	3.69	43	Norway	0.18	0.28	0,34
9	Italy	3.18	2.78	3.14	44	New Zealand	0.16	0.12	0,16
10	Spain	3.09	2.72	3.50	45	Romania	0.16	0.11	0,08
11	Canada	2.78	2.48	3.52	46	Egypt	0.16	0.29	0,15
12	Taiwan	2.14	3.20	3.04	47	Chili	0.15	0.30	0,48
13	India	1.92	2.28	0.74	48	Republic of South Africa	0.14	0.03	0,11
14	Poland	1.48	1.44	2.02	49	Georgia	0.12	–	–
15	Netherlands	1.36	1.03	1.45	50	Iran	0.12	0.60	0,28
16	Brazil	1.32	1.90	1.81	51	Turkey	0.12	0.28	0,15
17	Sweden	1.22	1.30	1.64	52	Venezuela	0.12	0.07	0,09
18	Argentina	1.19	0.87	1.34	53	Morocco	0.11	0.12	0,09
19	Switzerland	1.15	0.93	1.48	54	Tunisia	0.06	0.05	0,04
20	Belgium	1.10	0.63	0.98	55	Puerto Rico	0.06	0.06	0,08
21	Israel	1.07	0.96	1.23	56	Jamaica	0.06	–	0,03
22	Australia	0.81	0.84	0.88	57	Armenia	0.05	0.02	0,01
23	Ukraine	0.66	0.37	0.32	58	Algeria	0.05	0.07	0,04
24	Finland	0.61	0.87	0.85	59	Cuba	0.04	0.01	0,02
25	Singapore	0.56	1.02	0.65	60	Saudi Arabia	0.04	–	0,02
26	Czech	0.56	0.40	0.48	61	Kuwait	0.03	0.12	0,04
27	Lithuania	0.37	0.67	0.25	62	Malaysia	0.03	0,14	0,02
28	Portugal	0.37	0.48	0.61	63	Luxemburg	0.03	–	–
29	Austria	0.35	0.23	0.24	64	Colombia	0.02	0.01	0,06
30	Hungary	0.34	0.60	0.76	65	Kazakhstan	0.02	0.01	–
31	Yugoslavia	0.34	0.07	0.31	66	Latvia	0,01	0.03	0,04
32	Greece	0.31	0.31	0.48	67	Bolivia	0,01	–	0,01
33	Croatia	0.31	0.29	0.31	68	Vietnam	0,01	0.03	0,01
34	Ireland	0.31	0.25	0.27	69	Uruguay	0,01	0.04	0,01
35	Belarus	0.29	0.15	0.17	70	Peru	0,01	–	–

* in three leading journals

Table 2.

**Information streams distribution in the field of electrochemistry in 1999 and 2002
(per capita)**

Nr.	Country	SDC	Nr.	Country	SDC
High level			Average level		
1.	Singapore	13,4 ± 4,1	41	Chili	0,90 ± 0,30
2.	Israel	10,4 ± 0,6	42	Ukraine	0,63 ± 0,17
3.	Sweden	8,7 ± 0,3	43	Brazil	0,60 ± 0,10
4	Switzerland	8,7 ± 1,5	44	Armenia	0,58 ± 0,25
5	Finland	8,7 ± 1,5	45	Latvia	0,50 ± 0,20
6	Japan	8,6 ± 0,1	46	Uruguay	0,50 ± 0,20
7	Lithuania	8,6 ± 2,5	47	Romania	0,37 ± 0,07
8	France	7,6 ± 1,8	48	Tunisia	0,35 ± 0,04
9	South Korea	6,8 ± 1,7	49	Mexico	0,29 ± 0,12
10	Estonia	6,6 ± 1,4	50	Iran	0,27 ± 0,18
28	Russia	2,7 ± 0,3	54	China	0,20 ± 0,03
35	Moldova	2,0 ± 1,0	58	India	0,13 ± 0,01
38	Belarus	1,3 ± 0,4	60	Republic of South Africa	0,11 ± 0,07

Table 3.

Contribution of different institutions of Moldova (1999 – 2002)

Nr.	Institution name	Share from total contribution, %
1	Technical University of Moldova	50
2	Institute of Applied Physics of ASM	40
3 – 5	State University of Moldova, Institute of Chemistry of ASM, Pridnestrovsky State University	~ 10

Table 4.

**Journals analyzed by JCR in the field of electrochemistry, in which the articles of
Moldavian researchers have been published for 1999 – 2002**

Nr.	Journal name	Share from total number of articles, %
1	Sensors and Actuators B: Chemical	50
2	Электрохимия (Russian Journal of Electrochemistry)	40
3 – 4	Electrochimica Acta, Electrochemistry and Solid State Letters	10

Table 5.

**Distribution of publication in journal «Elektronnaya obrabotka materialov»
(«Surface Engineering and Applied Electrochemistry») between countries
in 2002 (5 leading countries) and 2003**

N r.	Country	Share from total number of articles, %		Number of countries		% of articles with internat. cooper.	
		2002	2003	2002	2003	2002	2003
1	Ukraine	34,2	30,7	8	15	3,8	5,7
2	Moldova	26,6	22,2				
3	Russia	25,9	31,3				
4	Belarus	6,2	1,1				
5	Romania	3,8	0,6				

References

- [1] Дикусар А.И., Петренко В.И. Взаимное влияние и развитие электрохимии и электроники. Наукометрический анализ. Электронная обработка материалов. 5, 11 (2003).
- [2] Налимов В.В., Мульченко З.М. Наукометрия. М. Наука.. 1969.
- [3] Gibbs W.W. Lost Science in the Third World. Scientific American. 8, 76 (1995).
- [4] Дикусар А.И. Взаимное влияние процессов социально-экономического и научного развития общества. Науковедение. 2, 51 (1999).