

DYNAMICS OF DATA FLOWS ON THE LOW-ACTIVATED VANADIUM ALLOY FOR THERMONUCLEAR POWER ENGINEERING (ANALYSIS OF FOUR INTERNATIONAL DATA BASES)

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The paper presents the results of scientometric analysis of data flows in the International Data Bases SCOPUS, INSPEC, INIS, MSCI over a period since 1971 to 2014 on low-activated vanadium alloys suitable for operation as structural materials under extremely hard conditions in the future fusion reactors. The data on the dynamics of publications and contributions in them from the scientists of different countries have been obtained. The types and languages of publications have been identified. The analysis shows that investigations on the low-activated vanadium alloys are of current importance.

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It is well known that in many countries (e.g. France, Slovakia, Belgium and Ukraine) the primary energy source is a nuclear power. As the traditional energy resources are coming to an end the role of nuclear power is growing steadily. This will lead to the increasing amount of radioactive wastes some of which will be hazardous during many thousand years. Now there is an urgent need for nuclear waste reprocessing into the safety state. Therefore during recent decades of years in different countries the researchers develop the materials being low-activated under irradiation with neutrons, gamma-rays and charged particles. These materials can be used for developing the future thermonuclear power as a reliable and safety energy source. The matter concerns the first wall, blanket and other reactor parts. It is generally recognized that the best candidates for structural materials are SiC/SiC composites [1], tungsten [2], ferritic-martensitic steels, dispersion oxide-hardened steels [3] and vanadium alloys. The development of such structural materials encounters some difficulties caused by very severe operating conditions: temperature jumps, high impulsive mechanical stresses, corrosive action, intense neutron irradiation (to 100...250 dpa) and irradiation induced by hydrogen ion fluxes (about 4400 appm per year) and helium ions (about 3500 appm per year). And the dose rate can be to 40 dpa per year. The above-mentioned values are characteristic for the demonstrational fusion reactor DEMO being builded now by international efforts. It is expected that in the future commercial fusion reactors the neutron irradiation can reach a level of 400 dpa, and the irradiation induced by the hydrogen flux generation can be 20000 appm (for helium 6000 appm) [4].

A purpose of the present paper is to consider the dynamics of data flows on the research and developments of vanadium alloys for thermonuclear power engineering, to know in which countries the scientists carry out such investigations, in which types

of information documents the reports are published and which languages are used for writing them.

By now the ternary V-4% Ti-4% Cr alloy is the most investigated [5]. It should be noted that recently low concentrations of impurities, e.g. Si, Al, Y, are under consideration, in particular, their influence on the V-4% Ti-4% Cr alloy making by rolling with reducing the interstitial impurity amount of oxygen to less than 180 ppm and of nitrogen to less than 100 ppm [6]. The conditioning effect of Ti and Zr impurities on the decrease of the gas swelling in the pure vanadium is studied too [7]. In view of the fact that the neutron irradiation provokes the helium and neutron appearance due to the nuclear reactions in the material, the gas swelling can drastically deteriorate its operating properties (in more detail see [8]).

In the present study for analysis the following International Abstract Data Bases (DB) were used:

- Universal DB SCOPUS (1966-2014) making a synopsis of 17000 scientific and technical journals edited by International Publishers ELSEVIER;

- Specialized DB INSPEC for Physics, Electronics and Computer Techniques (1969-2014) of the English Institute of Engineering and Technology abstracting 5000 journals;

- Specialized Cooperative DB INIS which is formed since 1971 to the present time by the participating states of IAEA (159 participants) reviewing scientific publications, including a so-called "grey literature";

- Specialized DB MSCI of the USA Institute for Scientific Information (1991-2011) abstracting 500 Journals of Materials Science published in different countries.

Information retrievals were carried out separately because of the differences in the software products of these DB and different DB population sources (Fig. 3).

Fig. 1 presents the results of investigations on the dynamics of publications on low-activated vanadium alloys, which are included into the Data Bases under consideration.

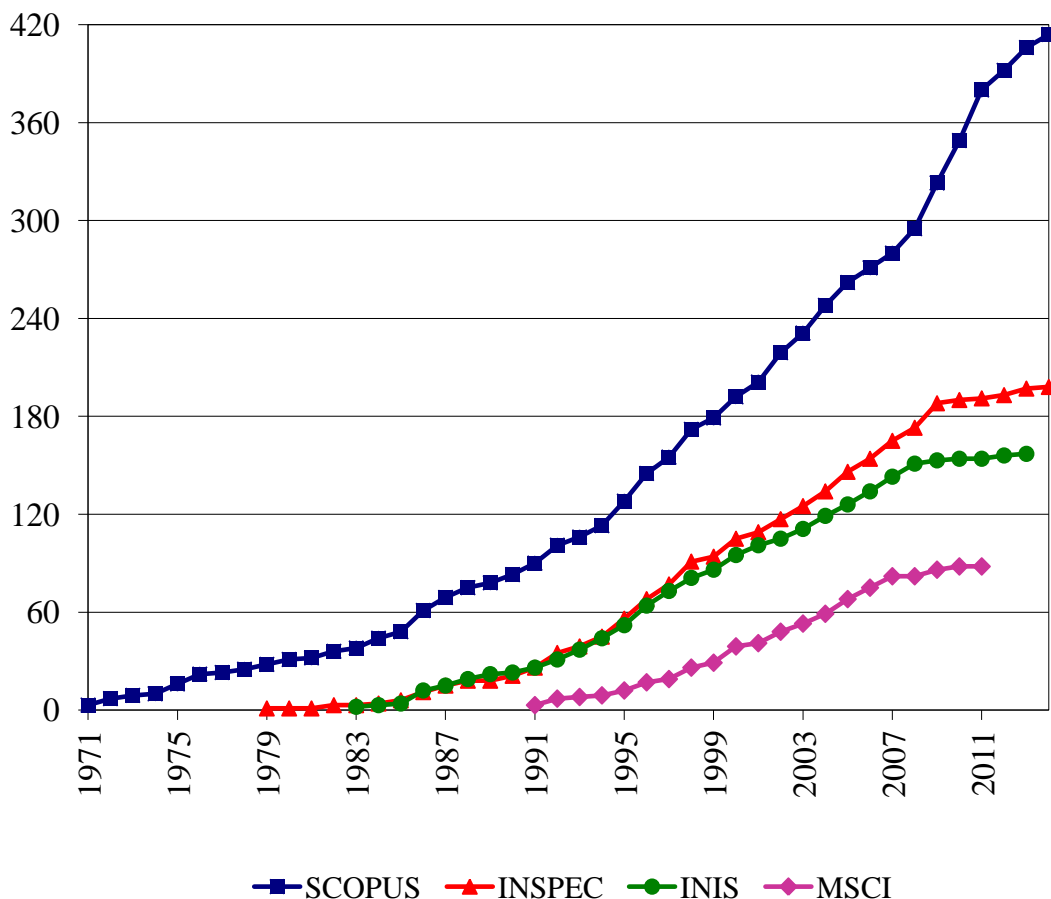


Fig. 1. Cumulative increase of the number of publications on the low-activated vanadium alloys included into the Data Bases

It is seen from the figure that approximately since 1990 the number of publications on the subject under consideration increases more rapidly. During the last 4-5 years this increase is slowing down. This is not because the main problems are, in general, cleared up, but because it is difficult to investigate these problems and the experimental results obtained at the International Thermonuclear Experimental Reactor (ITER) require a thorough analysis.

Fig. 2 presents the countries participating in the experiments on low-activated vanadium alloys. The leaders of publications are the USA, Japan, China (DB SCOPUS reviewing the papers of 35 countries); the Netherlands, the USA, Switzerland (DB INSPEC reviewing the papers of 10 countries); the USA, the Netherlands, International Atomic Energy Agency (IAEA) (DB INIS, reviewing the papers of 14

countries); Japan, the USA, Russia (DB MSCI reviewing the papers of 9 countries).

Besides the countries presented in Fig. 2 in these experiments participate the scientists from the following countries:

- Belgium, the Netherlands, Switzerland, India, South Korea, Austria, Spain, Ukraine, Brazil, Canada, the Czech Republic, Mexico, Turkey, Australia, Portugal, Taiwan, Bulgaria, Egypt, Iran, Israel, Malaysia, Rumania, Czechoslovakia, Singapore, Republic of South Africa, Finland and Venezuela (DB SCOPUS);

- Canada, Kazakhstan, South Korea, Poland, Rumania and Russia (DB INIS);

- Spain, the Netherlands and South Korea (DB MSCI).

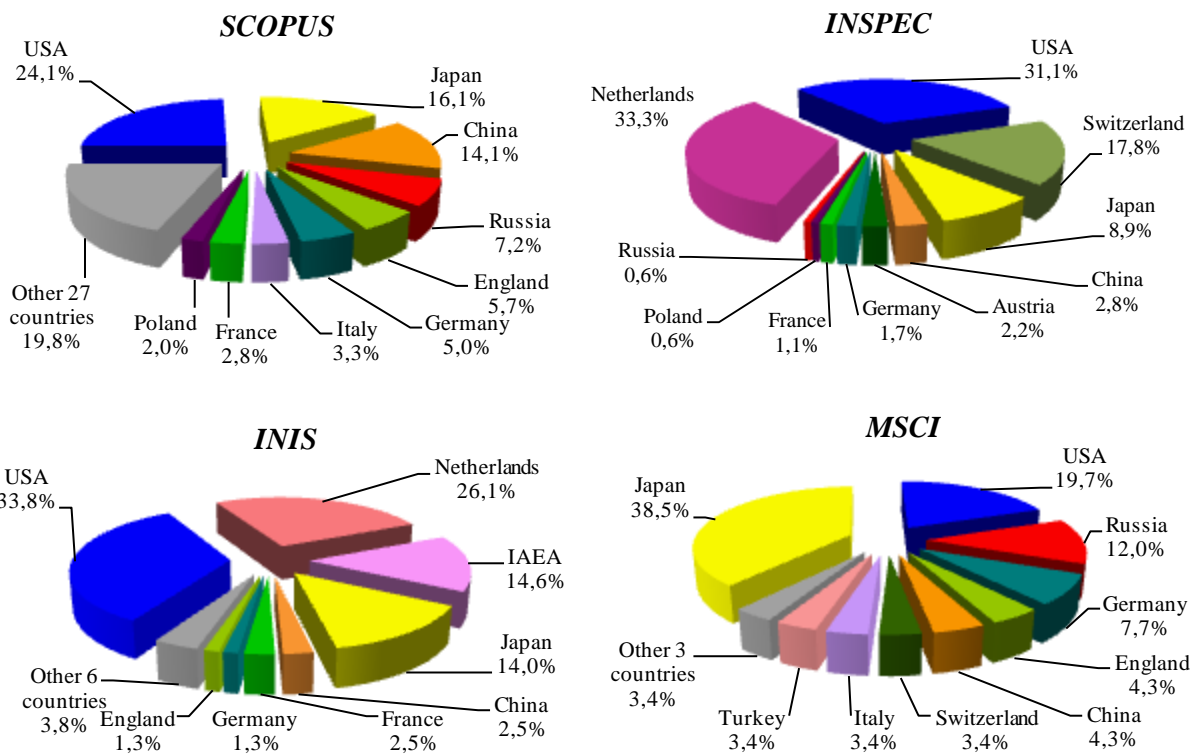


Fig. 2. Distribution of publications on low-activated vanadium alloys by different countries according to the data of corresponding Data Bases

Fig. 3 represents the types of publications on the low-activated vanadium alloys. In DB SCOPUS, INSPEC, INIS the main type of publications are articles in the journals (82%, ~ 64%, ~ 45% respectively). The second place take the proceedings of conferences (16% in DB SCOPUS, 34% in DB INSPEC) or reports (37%

in DB INIS). It is interesting that in the Science Materials DB MSCI the proceedings make about 57% and the articles make about 41% of publications that indicates on the great urgency of solving the material testing problems.

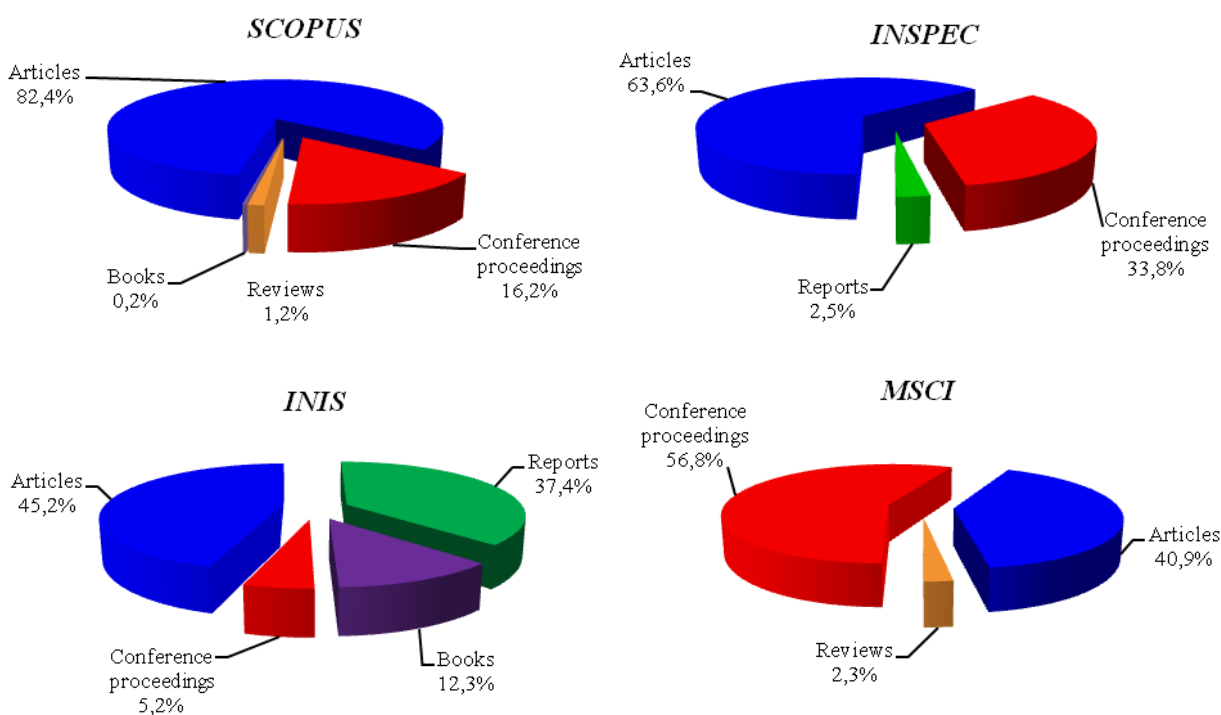


Fig. 3. Distribution of the corresponding informational papers by the types of publication

In all the DB the main language of publications on low-activated vanadium alloys is English (from 90 to 96%). There are also the publications in Chinese, Japanese, German, Russian, Swedish, Korean, French, Czech, Polish and Ukrainian languages.

CONCLUSIONS

The presented analysis of four International DataBases SCOPUS, INSPEC, INIS and MSCI shows that investigations and developments on low-activated vanadium alloys designed for application in the thermonuclear power engineering are of great importance today because the scientists of 35 countries are occupied with these problems. This is confirmed by a great number of publications, in particular, by a considerable quantity of proceedings of conferences.

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ДИНАМИКА ИНФОРМАЦИОННЫХ ПОТОКОВ ПО МАЛОАКТИВИРУЕМЫМ СПЛАВАМ ВАНАДИЯ ДЛЯ ТЕРМОЯДЕРНОЙ ЭНЕРГЕТИКИ (АНАЛИЗ 4-х МЕЖДУНАРОДНЫХ БАЗ ДАННЫХ)

А.Г. Шепелев, Ю.П. Курило, О.В. Кривченко

Представлены результаты наукометрического анализа информационных потоков за 1971-2014 гг. в Международных базах данных SCOPUS, INSPEC, INIS, MSCI по малоактивируемым сплавам ванадия, пригодным в качестве конструкционных материалов для работы в очень тяжелых условиях термоядерных реакторов будущего. Получены данные о динамике публикаций, вкладе в них ученых различных стран, выяснены типы и языки публикаций. Анализ показал, что исследования по малоактивируемым сплавам ванадия являются актуальными.

ДИНАМІКА ІНФОРМАЦІЙНИХ ПОТОКІВ ПО МАЛОАКТИВОВАНИМ СПЛАВАМ ВАНАДІЮ ДЛЯ ТЕРМОЯДЕРНОЇ ЕНЕРГЕТИКИ (АНАЛІЗ 4-х МІЖНАРОДНИХ БАЗ ДАНИХ)

А.Г. Шепелєв, Ю.П. Курило О.В. Кривченко

Представлено результати наукометричного аналізу інформаційних потоків за 1971-2014 рр. у Міжнародних базах даних SCOPUS, INSPEC, INIS, MSCI з малоактивованих сплавів ванадію, придатних в якості конструкційних матеріалів для роботи в дуже важких умовах термоядерних реакторів майбутнього. Отримано дані про динаміку публікацій, внесок в них вчених різних країн, з'ясовані типи і мови публікацій. Аналіз показав, що дослідження з малоактивованих сплавів ванадію є актуальними.