Ceramics International xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Ceramics International

journal homepage: www.elsevier.com/locate/ceramint

Global characteristics and trends of research on ceramic membranes from 1998 to 2016: Based on bibliometric analysis combined with information visualization analysis

Wenjie Li, Heng Dong*, Han Yu, Di Wang, Hongbing Yu*

College of Environmental Science and Engineering, Nankai University, No. 38 Tongyan Road, Jinnan District, Tianjin 300350, PR China

ARTICLE INFO

Keywords:
Ceramic membranes
Bibliometric analysis
Information visualization analysis
Citation burst

ABSTRACT

Using bibliometric analysis combined with information visualization analysis, this paper aims at investigating the global characteristics and trends of research on ceramic membranes. According to the 3697 publications from 1998 to 2016 in Science Citation Index Expended, this study was conducted from five major aspects, including basic growth trends analysis, countries/ territories and institutions analysis, categories and journals analysis, keywords analysis, and citation bursts detection. This study revealed positive growth trends of the research on ceramic membranes. The most productive countries and institutions were both from Peoples R China, and the collaborations among countries and institutions were frequent worldwide. The result of categories analysis revealed that the major discipline groups of the research on ceramic membranes were distributed in chemistry, physics, material, and application. Water resource, energy, environmental science and food engineering were the main application fields of ceramic membranes according to the journals analysis. Furthermore, three keyword clusters were identified, indicating that the main research directions of the research on ceramic membranes included membrane filtration, oxygen permeation and the fabrication of ceramic membranes. Finally, the top 20 citation bursts with the maximum burst strength were detected, indicating that the research on oxygen separation and water treatment has been flourishing in recent years.

1. Introduction

Ceramic membranes are a type of artificial membranes fabricated with inorganic ceramic materials through specific processes. The traditional but important function of ceramic membranes is to realize the separation of substances. Relying on the trans-membrane pressure and pore size, when the fluid with multiple components pass the ceramic membranes, the target substance will be separated from others. In recent years, the function of ceramic membranes has been extended to substances transformation via coating some catalytic materials on the surface [1]. Compared with organic membranes, ceramic membranes have many advantages such as good separation efficiency, excellent chemical resistance, high mechanical strength and stable thermal property [2]. Therefore, ceramic membranes have been widely used in many fields such as food [3], chemical engineering [4]and environmental protection [5,6]etc. It is noting that the ceramic membrane technique has been improved constantly and a growing body of research on ceramic membranes has been done, especially in recent years. Therefore, it is essential for the stakeholders to capture the state of art and development of the research on ceramic membranes.

The characteristics and trends of the research on a discipline can be reflected from the information of related publications [7,8]. However, it is hard for the stakeholders in this field to read all of the publications thoroughly, especially for the beginner. Certainly, this issue also existed in the research on ceramic membranes. Therefore, with the booming of the research on ceramic membranes, it is necessary to summary the existing research using an appropriate means to assess the characteristics and trends of the research on ceramic membranes.

Bibliometric analysis is a method to analyze the literature information based on mathematics and statistics but avoid people reading extensive publications [9]. By quantificationally analyzing some objects such as publications, countries, institutions, authors, journals, categories and keywords, bibliometric analysis can evaluate the present situation and growth trend of a specific research field in general [10]. However, it is difficult for traditional bibliometric to fabricate the collaboration or co-occurrence networks, which are also the important messages for relationship analysis of one research field. Moreover, bibliometric is unable to make cluster analysis, burst detection and other deep analyses. Information visualization analysis is an approach which can convert the complicated raw materials of publications into

* Corresponding authors.
E-mail addresses: wjli0056@163.com (W. Li), dongheng@nankai.edu.cn (H. Dong), hongbingyu1130@sina.com (H. Yu).

https://doi.org/10.1016/j.ceramint.2018.01.121
Received 16 December 2017; Received in revised form 10 January 2018; Accepted 15 January 2018
0272-8842/ © 2018 Elsevier Ltd and Techna Group S.r.l. All rights reserved.

the formats easy to observe [11]. Although information visualization analysis is not convenient to do the quantitative analysis, it is competent to conduct the network analysis [7], cluster analysis [12], burst detection [13] etc. Therefore, the method integrating the bibliometric analysis and information visualization analysis is much possible to assure the results of accuracy as well as comprehensiveness. There have been various research fields applying the bibliometric analysis or information visualization analysis, including environmental protection [9], medicine [14], information technology [15], energy [16], education [17] etc. However, most of the existing studies just used the single analysis tool and the burst detection were imperfect to give the comprehensive descriptions of the related research area. In addition, to our best knowledge, there is a lack of comprehensive and multi-perspective description of the research on ceramic membranes based on bibliometric analysis combined with information visualization analysis.

The aim of this study is to identify the characteristics and trends of the research on ceramic membranes based on bibliometric analysis combined with information visualization analysis. Using various analysis tools from different aspects, a comprehensive and multi-perspective summary of the research on ceramic membranes was given based the publications from 1998 to 2016. In more detail, the study was conducted from 5 main aspects according to the different analysis objects, including basic growth trends analysis, countries/territories and institutions analysis, categories and journals analysis, keywords analysis and citation bursts detection.

2. Materials and methods

The data collection was conducted on September 12th, 2017. Web of Science Core Collection was chosen as the source database, but only the publications recorded in Science Citation Index Expanded(SCI-E) from 1998 to 2016 were collected in this study. “Ceramic membrane*” was used as the topic keyword and then 3697 records were found. The 3697 full records and their cited references were downloaded as the raw materials for further analysis. Of all collected publication records, article (3052, 82.55%) is the most frequent publication type, followed by proceeding paper (474, 12.82%), review (133, 3.60%), meeting abstract (25, 0.68%) and others (13, 0.35%).

The statistical data, such as the information of publications, authors, pages, citations, journals and categories, were calculated by Excel and HistCite [18]. The basic collaboration networks between institutions and countries were waved by VOSviewer [19,20] and the graphical collaboration map was fabricated by Citespace [8,21]. In addition to the network analysis, the VOSviewer and Citespace were also used to find the keywords clusters and detect the citation bursts, respectively.

3. Results and discussion

3.1. Basic growth trends analysis

The trends of the number of publications and average number of authors per publication are shown in Fig. 1. It is evident that the number of publications increased steadily despite some fluctuations, which was 118 in 1998 but increased into 331 in 2016. This phenomenon reveals that the research on ceramic membranes has attracted an increasing attention. Similarly, the average number of authors per publication also increased in general, from 3.64 in 1998 to 4.94 in 2016. This rising tendency indicates the increasingly close collaborations between authors. Fig. 2 shows the trends of the average number of references, citations and pages per publication. As is shown in the figure, there was an increasing tendency of the average number of references from 1998 to 2016. The average number of references reached 43.15 in 2016, about 2 times many as that of 21.31 in 1998. The increasing number of the publications available for reference may be one reason for this phenomenon. Another reason is that the journals need more sufficient evidences to make the publications more convincing

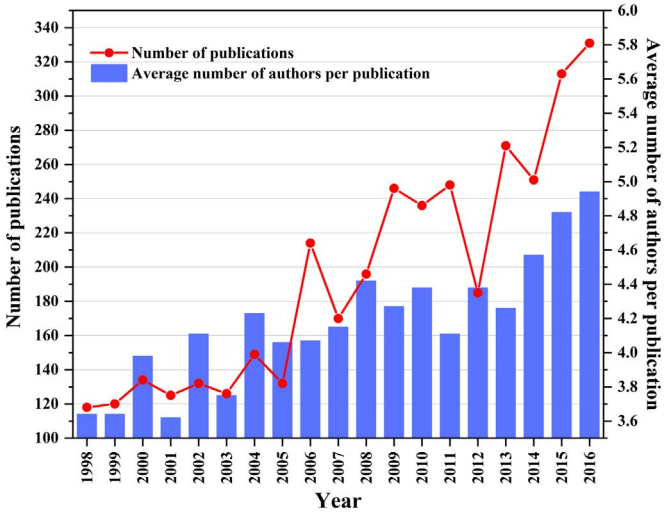

Fig. 1. Trends of the number of publications and average number of authors per publication.

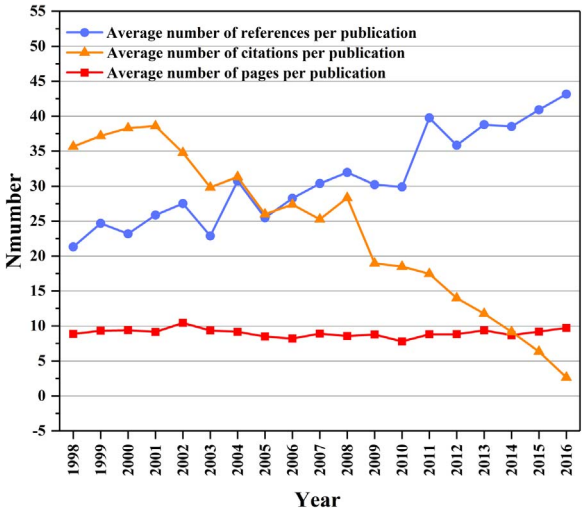

Fig. 2. Trends of the average number of references, citations and pages per publication.

with the development of the quality of journals. The average number of citations per publication showed an increasing tendency at the beginning of the collection period, then peaked at 38.58 in 2001. However, it decreased sharply from then on, which was just 2.65 in 2016. The reason for this declining phenomenon may be that the new publications need adequate time to accumulate the citations. Interestingly, the average number of pages per publication fluctuated around 9 slightly with no evident growth trend, indicating the length of publications was steady.

3.2. Countries/territories and institutions analysis

3.2.1. Countries/territories analysis

According to the 3697 records collected, there were 75 different countries/territories that published their works on ceramic membranes in SCI-E from 1998 to 2016. It is noted that 70% of the countries/territories published more than 10 works but 12% of the countries just published a single work. Table 1 lists the top 20 most productive countries. To evaluate the quality of publications, TLCS and TGCS were introduced as metrics. TLCS represents the total local citation score, which shows the total number of citations of all publications from a specific country based on the local records. TGCS represents the total global citation score, showing the total number of citations of all

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
✓ امکان دانلود نسخه ترجمه شده مقالات
✓ پذیرش سفارش ترجمه تخصصی
✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
✓ دانلود فوری مقاله پس از پرداخت آنلاین
✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات