

Scientometric Analysis of Long Afterglow Luminescent Materials

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Abstract: Long afterglow luminescent materials have attracted extensive attention in various fields due to their unique optical properties. Although several literature reviews have been conducted on the research field of long afterglow luminescent materials, there is still a lack of systematic and comprehensive combing and analysis. In this study, a scientometric review of long afterglow luminescent materials was carried out based on the Web of Science core set data using VOSviewer and HistCite visualization and analysis software, and the research results can provide a reference for the research in the field of long afterglow luminescent materials.

Keywords: Long Afterglow Luminescent Materials; Scientometrics; VOSviewer; HistCite

Introduction

Long afterglow luminescent materials are a class of photoluminescent materials that can utilize the stored energy to continue to emit light after the excitation stops, forming a long-lasting afterglow luminescence phenomenon ^[1]. In recent years, researchers have developed a variety of new long afterglow materials with more and more applications, and the related research results are increasing year by year, so it is of great significance to carry out the related literature analysis to comprehensively understand the current status and development trend of the research in this field.

Scientometrics is a discipline that applies quantitative methods to assess and analyze scientific research activities and their impact. It integrates theories and methods from a variety of fields, including statistics, informatics and philosophy of science, and focuses on revealing the characteristics and trends of scientific communication, scientific research results, the influence of researchers and the performance of academic journals through data analysis ^[2]. With the development of big data and information technology, scientometrics has been widely used in various disciplines, providing strong support for the continuous development of scientific research ^[3]. Based on the principle of scientometrics, this paper analyzes the research status of long afterglow luminescent materials, aiming to reveal the research hotspots and development trends in this field, provide references for relevant research workers and decision makers, and promote the sustainable development of this field.

1. Research Methodology

1.1 Data sources

Using the Web of Science core ensemble database as the data source, the search strategy was TS=(“long afterglow*” OR “Room temperature phosphorescen* “ OR “persistent luminescen*” OR “long persistent*” OR “long persisten* phosphor* “ OR “long phosphorescent phosphor” OR “long lasting phosphor* The search period was from January 1, 2004 to December 31, 2023, and the document language type was set to “English”, and the document types were “article” and “review”. The language type of documents was set as “English”, and the types of documents were “article” and “review”, and a total of 6,510 relevant documents were obtained. The format of the exported documents is “plain text file”, and the content of the records is “full record and cited references”.

1.2 Research tools

In this study, we use a combination of VOSviewer and HistCite software to explore the research dynamics of long afterglow luminescent materials. VOSviewer is a scientific knowledge mapping software developed by Van Eck and Waltman of Leiden

University in 2009, which can perform collaborative, thematic, and citation analyses to generate various types of visualizations, and can also perform overlay visualizations. HistCite is a set of citation chronology visualization program developed by Garfield, a famous scientometrician, which can quickly identify the core literature in the field by analyzing the citation relationship between the literature and show the development history and evolution trajectory of the research, helping researchers to sort out the research lineage of the field and predict the future trend.

2. Results

2.1 Analysis of journals

Co-cited journals were analyzed using VOSviewer software to find the most influential journals in the research area. As shown in Figure 1A, the journals that were included in the visual analysis with at least 600 citations had a total of 97 nodes and 4 clusters in the network graph. The five journals with the highest co-citation frequency were *Angewandte Chemie-international Edition*, *Journal of the American Chemical Society*, and *Advanced Materials Journal of Luminescence and Journal of Materials Chemistry C*. *Angewandte Chemie-international Edition* has the highest total link strength in the web atlas, indicating that the journal has an important position in the research field. It has an important status and has published many high-impact, high-quality studies that have attracted great attention from researchers. It can be inferred that these high-profile journals may publish more high-impact studies in the future.

2.2 Country/Region Analysis

VOSviewer was used to draw a cooperative relationship network graph for countries/regions with ≥ 49 publications, in which nodes represent individual countries, node size represents frequency, connecting lines between nodes indicate cooperative relationship, connecting line thickness indicates cooperation strength, and colors of nodes and lines indicate clustering. As shown in Figure 1B, China, the United States, and Japan have the most connecting lines in the graph and are at the forefront of global cooperation. With the advantage of the number of articles, China has established cooperation with 50 countries or regions, including the United States, Singapore and Japan, and has the highest total link strength, with the highest frequency of cooperation with the United States and Singapore. France, although it has only 190 articles, has established cooperative relations with 42 countries, with closer cooperation with China, India and Japan.

2.3 Institutional analysis

The main institutions currently conducting research are the Chinese Academy of Sciences, University of Chinese Academy of Sciences, Guangdong University of Technology, Lanzhou University, South China University of Technology, CNRS, Tianjin University, Nanjing University of Technology, Sun Yat-sen University and Jilin University. Among the top ten institutions in terms of the number of publications, nine institutions are from China and one institution is from France, which indicates that China has

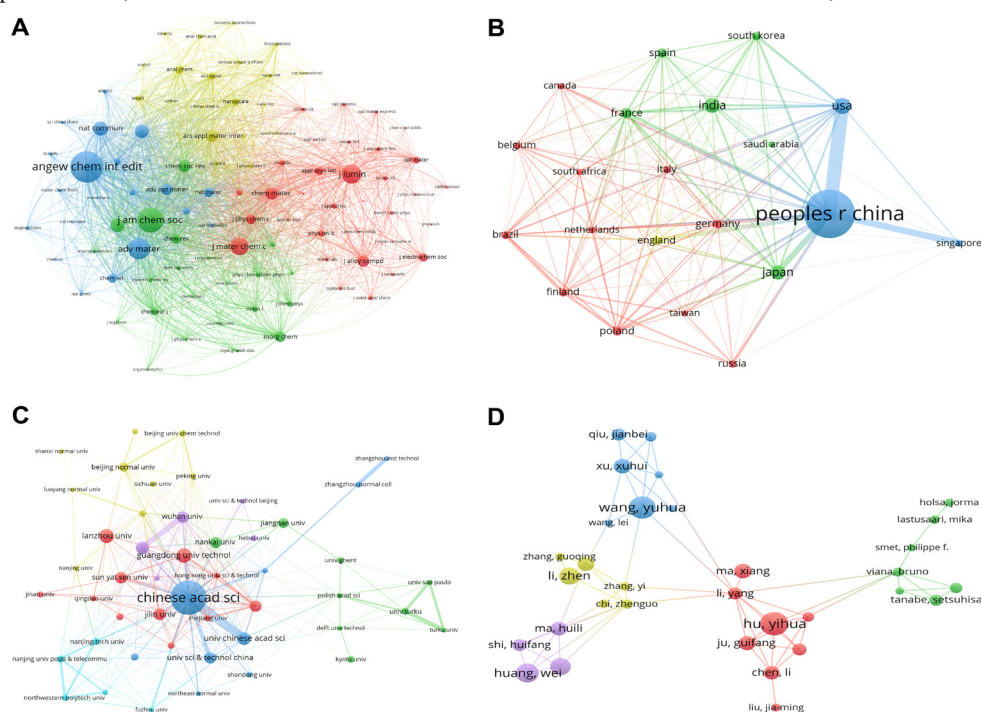


Fig. 2. (A) Co-citation journal network visualization map. (B) The network of countries co-occurrence analysis. (C) The network of institutions co-occurrence analysis. (D) The network of authors co-occurrence analysis.

high attention and investment in this field and is the main contributor to the scientific research results. VOSviewer software was used to draw the network diagram of institutional cooperation relationship, as shown in Fig. 1C, the cooperation among institutions has a certain geographical nature, which was divided into six clusters, forming a cooperation cluster with the institutions with higher publication volume as the core institutions.

2.4 Author Analysis

The number of publications by scholars is an important symbol for evaluating their academic research ability and level, and highly productive scholars are usually professional leaders in specific subject areas. The top 10 authors are Hu, Yihua, followed by An, Zhongfu, Huang, Wei, Wang, Yuhua, Li, Zhenjiang, Lastusaari, Mika, Tang, Ben Zhong, Xu, xuhui, Ju, Guifang, and Ma, Huili, in that order. Nine of the top ten authors are from China, indicating that Chinese scholars are leading in this field. Using VOSviewer software to draw the network diagram of authors' cooperation relationship, as shown in Fig. 1D, the research field of long afterglow luminescent materials has formed several research teams with high-productivity authors as the core, but there are fewer network connections between the teams, and there is a lack of cooperation between the teams, which is dominated by intra-institutional cooperation, and has not formed a larger group of authors' cooperation.

2.5 Trend analysis of literature issuance

As shown in Figure 2A, the overall trend of the number of long afterglow luminescent materials literature from 2004 to 2023 shows a continuous dynamic growth. Combined with the actual situation of research progress, the research on long afterglow luminescent materials can be categorized into a slow growth phase and a rapid growth phase.

2.6 Knowledge base analysis

As shown in Figure 2B, looking at the evolution of literature citation relationships, research has been gradually active since 2012, with multiple influential literature nodes appearing one after another, forming a tightly connected citation network structure. Among them, 903, 1130, and 1101 are articles with seminal impact, and most of the subsequent studies have citation relationships with these three core documents, thus these four documents have strengthened the foundation for subsequent studies [4]. The core documents, 1687, 1595, 1645, 1397, 1772, 1971 and 1928, serve as a carrier throughout the network. In 2019-2020, there is a significant increase in the number of published literature, and the core literature is all in the review category, including 2770, 2834, and 3785, the study of which will help to get a quick overview of the research on long afterglow materials.

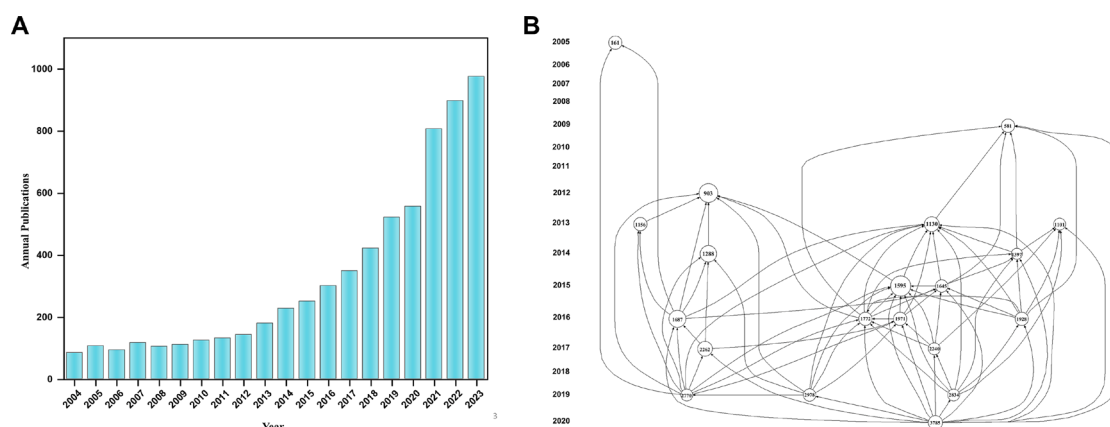


Fig. 2. (A) The annual publication volume from 2004 to 2023. (B) Chronological Citation Map of Core Literature.

3. Conclusion

In this study, based on the Web of Science core set database, 6510 literatures on the topic of long afterglow luminescent materials were collected between 2004 and 2023, and the journals, countries, institutions, authors, and knowledge bases were analyzed in depth by using the visual mapping software to reveal the current status of research in this field.

References:

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