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A bibliometric review of Dissimilar Welding between Stainless Steel and Carbon Steel

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Abstract

Connecting metals becomes a technique for generating materials with the most desirable qualities. Stainless steel and carbon steel will be blended for this research. According to the author's search findings, a bibliometric examination of dissimilar welding between stainless steel and carbon steel was conducted in 2022. This issue is intriguing to explore for a reason stated. The findings of the bibliometric study may contribute significantly to the future expansion of research. The information input gained may motivate researchers to uncover research-relevant flaws. A total of 748 relevant articles will be analyzed for this purpose. This article examines the link between scientific research conducted by local and international collaborating writers and the topic's development. The data indicate that this area of study is expanding. Mechanical property testing and microstructure analysis are the most often used parameters. In addition to exposing the correlation and dominance of publications, bibliometric analyses illustrate the topic's progression through time. The analysis's findings on dominance may serve as a guide for future studies on the topic. In addition, the analytical findings might identify themes or issues that were never addressed in prior research.

Keywords: dissimilar welding, dissimilar, welding, stainless steel, carbon steel, bibliometric

1. Introduction

Currently, there is a rise in research aimed at identifying materials that may be used to treat certain illnesses. Combining two distinct kinds of metals is one method for producing metals with distinctive characteristics [1]. Two metals may be mixed to provide qualities that cannot be found in regular steels [2]. In the current industrial sector, durable, lightweight, and high-performance items with distinctive characteristics are in high demand. That is one sort of innovation for the growth of the industrial sector [3]. To be using a welding method, two metals with distinct physical and chemical characteristics may be joined to produce specified attributes [4], [5].

Fusion welding, low-dilution, and non-fusion welding are used when combining dissimilar materials. Fusion welding includes the Manual Metal Arc, Gas Tungsten Arc, and Submerged and Flux Cored Arc processes. The fusion welding procedure is used for high productivity and various welding detail requirements [6]. Electron beams, laser, and pulse arcs are all low-dilution welds. The base metal in a Weld with low dilution melts in minute quantities. In general, the filler metal is not necessary for this procedure. Non-fusion welding includes friction welding, explosion welding, diffusion bonding, and soldering and brazing [7].

Weld analysis for carbon steel, stainless steel, and filler metal was modified and posted for the first time in 1971 [8]. From that first study, more research was conducted

with several parameter modifications [9],[10]. Scopus has become a comprehensive data supplier for statistical analysis requirements. Scopus was first offered to the public in 2004 [11]. On December 21, 2022, the data search for the keyword sequences "stainless steel", "carbon steel", "arc", "dissimilar", and "welding" yielded more than 1,000 results. With restrictions like document type and language, it returns 748 results. The collected articles will be analyzed using statistical methods [12].

In the area of study on carbon steel and stainless-steel welding, searching with the appropriate keywords might facilitate data acquisition [13]. The acquired statistics give an overview of aspects such as the prevalence of research and its advancement, including nations and researchers. This page compiles Scopus-published data until 2022. The data will be evaluated using the bibliometric technique [14]. This study enables researchers to determine the amount of popularity and gaps in the research area. This study's bibliometric analysis focuses on a comprehensive review [15][16]. This study may influence technological advancement, research, and education.

This study is based on information on the research of stainless steel and carbon steel welding, research trends, author relations, and article and research development directions. The maximum number of records that may be retrieved simultaneously from the Scopus database is 2000 [17]. The data is further analyzed using VOSViewer, RStudio, and Biblioshany software to generate a conceptual map. From the conceptual map, bibliometrics provides information on relevant research, subject trends, and the benefits and drawbacks of the gathered data. The findings of this analysis may give detailed information from the data samples collected for further study.

2. Methods

Related Studies

In general, bibliographic data from online sources were employed to compile the data in this research. Scopus [18], Web of Science [19][20], Google Scholar [21][22], and Web of Knowledge [23] are utilized as databases. Numerous areas [24] have used bibliometric analysis to undertake studies with copious data [25]. The bibliometric analysis technique has never been used to study dissimilar welds between stainless steel and carbon steel. That is the first investigation into welding stainless steel with carbon steel. This study can give complete information about the development of welding with materials other than stainless steel and carbon steel.

Scopus is the most popular option for bibliometric analysis as a source of research data [26]. Several prior research serves as references for the current study. A Scopus database search using the terms "bibliometric" and "welding" yielded prior research. The search results are then restricted to the terms "engineering" and "materials science" The combination of keywords and restrictions yielded 29 papers related to bibliometric analysis in the welding discipline. Table 1 displays the bibliometric analysis conducted in a comparable field of research as this one.

Table 1. List of bibliometric analysis studies in the field of welding - Scopus database.

Authors	Presented Study
Yin et al., 2020 [27]	Investigation on Corrosion Resistance of Welded Cu-Bearing 304L Stainless Steel Against Pseudomonas Aeruginosa
Layus et al., 2015 [28]	Big Data bibliometric research of welding scientific publication in 10 years period

Authors	Presented Study
Yang et al., 2022 [29]	Research progress on the microstructure and mechanical properties of friction stir welded Al–Li alloy joints
Iman et al., 2021[30]	A bibliometric analysis on friction stir welding

Data Preparation

Publication data suppliers must offer bibliographic data in file format for bibliometric research. This information may be extracted from the Scopus database, which is the principal source of articles and is widely used in bibliometric research. Scopus's data collection spans several domains of knowledge. The highest number of samples that may be gathered in a given time is 2,000, which can include several components. Scopus data components include authors, citations, and other information. The data may also be presented in CSV [31] or BibTeX format [32], which can be analyzed using VOSviewer [33], RStudio, and Biblioshiny software [34].

RStudio is an integrated development environment (IDE) for the "R" programming language. The "R" programming language provides a syntax-highlighting editor interface for direct execution, workspace management, history viewing, and planning capabilities. Biblioshayne may be required to process the data collected from library-related research outcomes. Connect to this console. Biblioshiny needs a CSV or BibTeX database file as input. The database may contain author and artifact links. In general, the outcome of processing Bibiloshiny may manifest in various formats. A chart or table may be used to represent the outcomes of data processing.

VosViewer also utilizes data in CSV and BibTeX file formats. The distinction between the two applications lies in how data processing results are shown. Display processed data as a network map in VosViewer. This diagram illustrates the network of connections between researchers, nations, authors, and organizations. Using bibliographic databases (such as Scopus, Web of Science, Dimensions, PubMed, and Lens) and reference management files (RefWorks, EndNote, and RIS), the network may be constructed. VOSViewer data may also be retrieved using APIs (e.g., Crossref API, Open Alex API, Europe API) [35], [36].

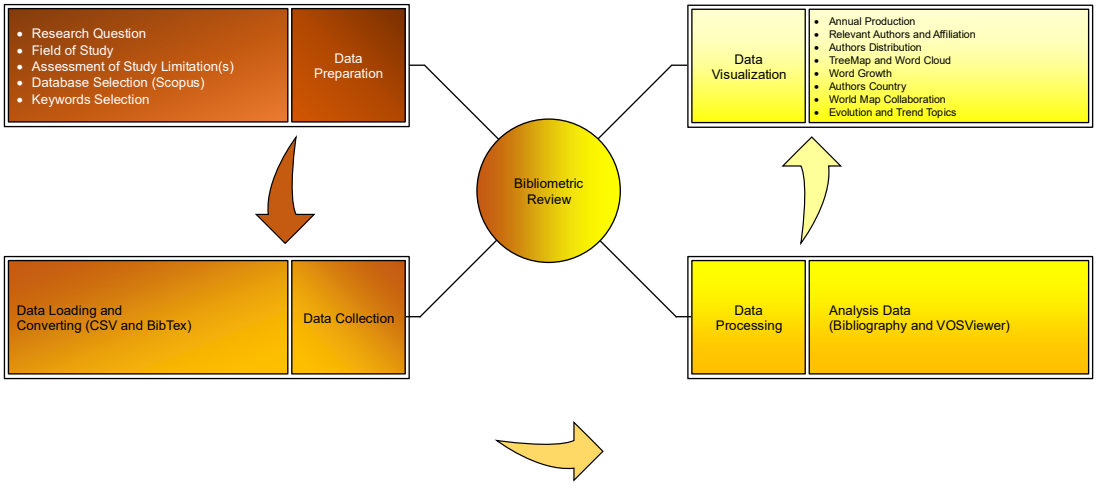

Figure 1. Bibliometric analysis methodology flow.

Beginning the bibliometric analysis are research limits such as keywords, research kinds, and domains. The gathered data must be formatted as CSV or BibTeX files. The procedure using Vosviewer and Biblioshiny software may provide interpretable data through visualization maps, tables, and graphs (Figure 1). The analysis's final findings include author, citation, country, author cooperation, and author significance information. The chosen categories are then investigated in depth. The kind of article, the quantity of growth, keywords, and other categories may be shown as maps, graphs, and tables for in-depth analysis.

It utilized bibliometrics to map the first research categorizing stainless steel and carbon steel. The study is then conducted using a descriptive method to characterize the growth direction of research into welding stainless steel and carbon steel. A combination of initial mapping and biometric analysis may provide more precise data about previous research's evolution, advantages, and shortcomings. The discovery may take the shape of current research trends or research criteria. It may provide fresh insights and chances for future study.

The data for this research were extracted from Scopus-indexed papers. Table 2 displays articles and general information extracted from keyword-driven search results until 2022. There were as many as 748 items returned by a search using keywords and limits. (Title-ABS-KEY ("stainless steel")) and ((((("carbon steel")) and ("arc")) and ("different")) and ("welding") and (not including (PUBYEAR, 2023)) and (limit-to (PUBSTAGE, "final")) and (limit-to (language, "English")) and (limit-to (SRCTYPE, "j")) and (limit-to (DOCTYPE, "ar")).

Table 2. Main information about publication data in the field of dissimilar welding stainless steel and carbon steel.

Description	**Results**
MAIN INFORMATION ABOUT DATA	
Timespan	1971:2022
Sources (Journals, Books, etc)	214
Documents	748
Annual Growth Rate %	9.9
Document Average Age	4.54
Average citations per doc	16.37
References	25644
DOCUMENT CONTENTS	
Keywords Plus (ID)	3636
Author's Keywords (DE)	1783
AUTHORS	
Authors	2209
Authors of single-authored docs	10
AUTHORS COLLABORATION	
Single-authored docs	13
Co-Authors per Doc	4.35
International co-authorships %	16.31
DOCUMENT TYPES	
Articles	748

This research examined the topic of welding stainless steel and carbon steel dissimilarly. The utilized data ranges from the initial research conducted in 1971 through 2022. According to Table 2, there were 748 publications for a total of 25,644 references from 214 unique sources, including books and journals, over time. The average number of citations per document was 16.37, and the yearly average number of citations per document was 4.54. Shamanian M [37][38] is recognized as the author with the most articles in the Scopus database, having 18 papers in this study period. Figure 2 provides an overview of the number of publications published annually concerning this subject of articles published each year related to this study are displayed in Figure 2.

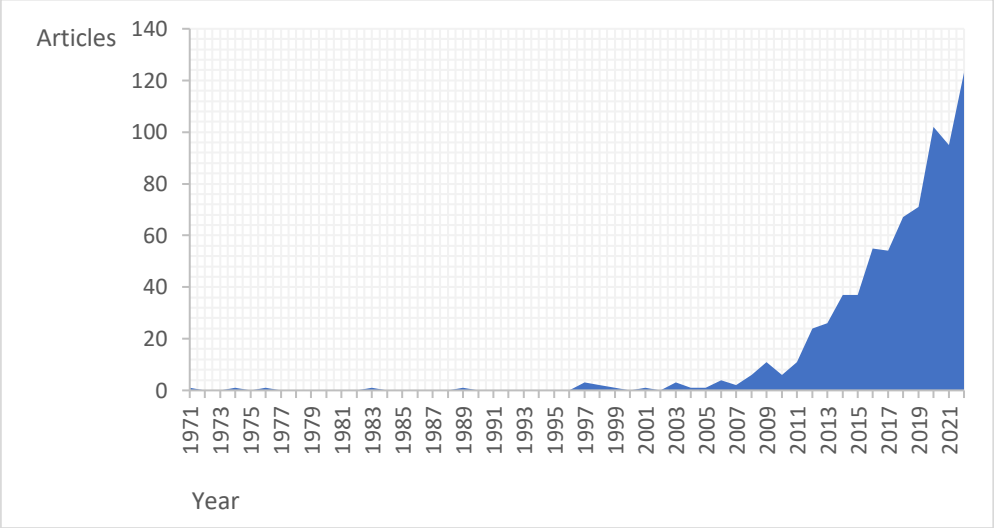

Figure 2. Annual Scientific Production

Figure 2 shows the publication growth of the dissimilar welding field between stainless steel and carbon steel until 2022. In 2011, 11 articles were published, more than twice the previous year's total. That marked the beginning of a considerable rise. Consistently, the number of articles will increase until it reached a maximum of 123 in 2022. According to Table 2, a total of 2,209 writers contributed to the publishing of 748 publications on the subject. Thirteen of the papers in this research were written by a single author.

Author Domination

An author's dominance may be measured by the number of published papers and citations received. That is affected by the article's publication date [39]. Figure 3 depicts the author information found in most of the publications included in this analysis. Shamanian M., from Isfahan University of Technology in Isfahan, Iran, surpassed the other writers by publishing 18 publications. Table 3 displays data acquired by Biblioshiny on author dominance based on the number of citations and affiliations. Figure 4 demonstrates that in addition to Biblioshiny, author dominance based on the number of articles, article linkages, and citation number throughout the research period also used VosViewer.

Table 3. Author Affiliation and Total Citation

No.	Authors	Affiliation	Articles	Total Citation
1	Shamanian M	Isfahan University of Technology, Isfahan 84156-83111, Iran	18	574
2	Zhang, Y	China University of Petroleum, Qingdao 266555, PR China	16	234
3	Liu, Y	Nanchang University, Nanchang 330031, China	14	218
4	Arivazhagan, N	VIT University, Vellore 632 014, India	13	465
5	Li, J	Tianjin University, Tianjin 300072, China	13	141
6	Wang, C	Huazhong University of Science and Technology, Wuhan 430074, China	11	316
7	Dong, H	Dalian University of Technology, Dalian 116085, PR China	10	313
8	Li, Y	Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China	9	289
9	Yang, J	Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China	9	158
10	Huang, Y	Tianjin University, Tianjin 300072, China	8	70

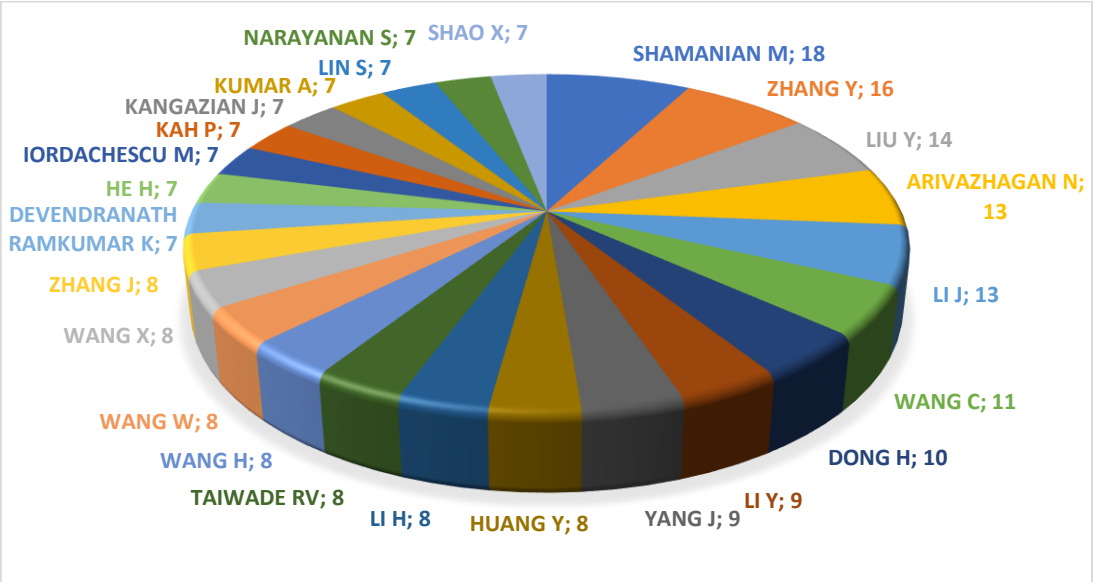

Figure 3. Most Relevant Authors in dissimilar welding Stainless Steel-Carbon Steel

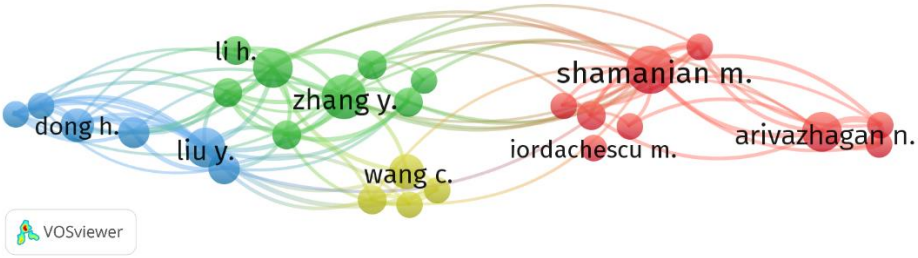

Figure 4. Results of the author's distribution map

The Use of Keywords

Using relevant keywords has a significant impact on the article search process. The amount of scientific works that may be referenced depends on the phrases used. Indirectly, keywords impact the author index as well (Figure 3). Microstructure, mechanical characteristics, stainless steel, and welding are the most common terms, as determined by a study of three map models. In addition to the three previous map analyses, tensile strength and arc welding is the most often occurring terms in the word cloud analysis. These findings are considered for the determination of future study parameters.

Authors Impact and Collaboration

Typically, a new study strategy is motivated by past research. Previous research publications in various media, such as articles and books, might serve as references for future studies. The amount of citations an author receives indicates the impact of prior research. Research is achievable in the form of local and worldwide collaboration. A few of the papers in this study are the product of collaborative research and writing. Analysis can reveal the impact of authors and nations that contribute to collaborative research. Indicating a probable nation for co-authorship, this is a given.

3. Result and Discussion

Analysis of stainless steel and carbon steel welding has been conducted for over fifty years. This is obvious from a 1971 paper, the first article in the Scopus database. In the Scopus database, there is no investigation of dissimilar welding between stainless steel and carbon steel to serve as the foundation for this work. On this premise, it is also possible to infer that this study represents an original contribution. The era covered by this study data is from 1971 to 2022. This research examined author dominance, keywords, local and worldwide collaboration, and the author's influence. In this assessment, Biblioshiny and VosViewer will be utilized to conduct a descriptive analysis.

By picking the appropriate keywords, the study topic may be determined. The outcomes of this examination provide a wide range of intriguing inferences. As shown in Table 2, there were 748 publications involving 2209 authors over the research period. The trend of growing publication numbers peaked in 2022 when 123 papers were published (Figure 2). Shamanian, M., with 18 publications, dominates the authorship over the timeframe of the research. (Figure 3 and Table 3) Consistency in transcribing names from Scopus data to CSV format may lead to a decline in dominance. For instance, if "Wang, C" is checked, it might have several names, such as Wang Chaochao and Wang Caimei.

With Biblioshiny, the study's word growth rate may be shown graphically. As seen in Figure 5 and Figure 6, the display may take the shape of a TreeMap or Word Cloud. The

most-discussed term regarding treemap viewing is its microstructure. In addition, the word stainless steel appears most often in Table 4. Tensile strength is the most frequent phrase in Word Cloud. Welding is the most frequent term in this visualization. GTAW and GMAW are the exact kinds of welding shown. This may expand the possibilities for performing new research utilizing the electric arc technique.

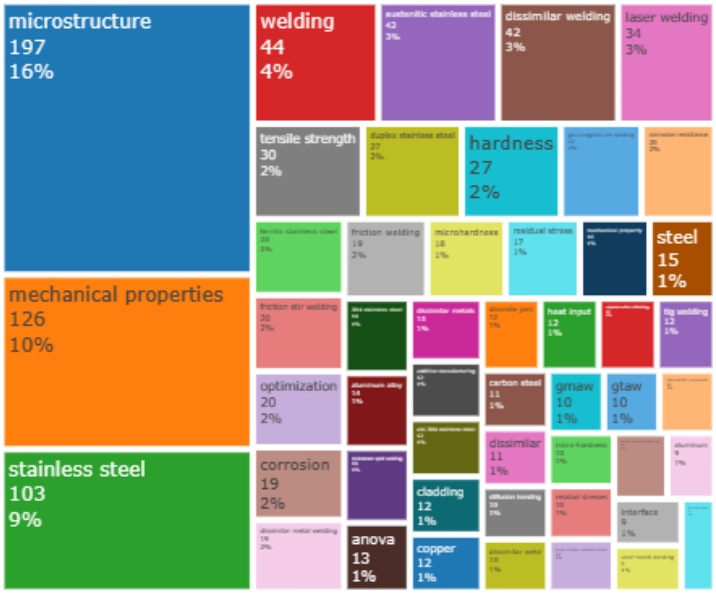

Figure 5. Tree map using author's keywords on dissimilar welding Stainless Steel-Carbon Steel

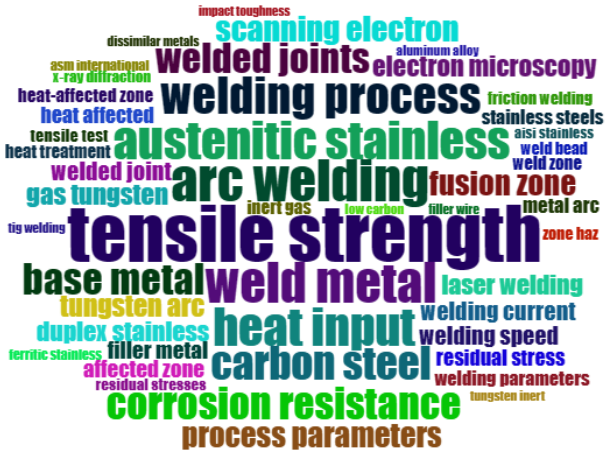

Figure 6. The results of the Scopus database analysis in the field of dissimilar welding Stainless Steel-Carbon Steel

Table 4. Most frequent author keywords in the field of dissimilar welding Stainless Steel-Carbon Steel

No.	Keywords	Frequency
1	stainless steel	885
2	mechanical properties	329
3	tensile strength	305

No.	Keywords	Frequency
4	arc welding	226
5	weld metal	216
6	austenitic stainless	205
7	heat input	205
8	welding process	199
9	carbon steel	180
10	corrosion resistance	174
11	base metal	169
12	welded joints	163
13	scanning electron	137
14	fusion zone	133
15	process parameters	132
16	tungsten arc	117
17	gas tungsten	112
18	electron microscopy	111
19	duplex stainless	108
20	laser welding	107
21	welded joint	100
22	welding current	100
23	welding speed	98
24	filler metal	94
25	affected zone	93

Figure 7 depicts an essential word increase in this investigation. Similarly, the term with the most significant growth in Table 4 was "stainless steel." According to TreeMap's study, stainless steel comprises 9 percent. That suggests that stainless steel remains the material of choice for this study. The most common form of stainless steel is austenitic. The most prevalent tests include mechanical characteristics. The prevalent testing emphasis is tensile strength. An electric arc is employed as the weld procedure.

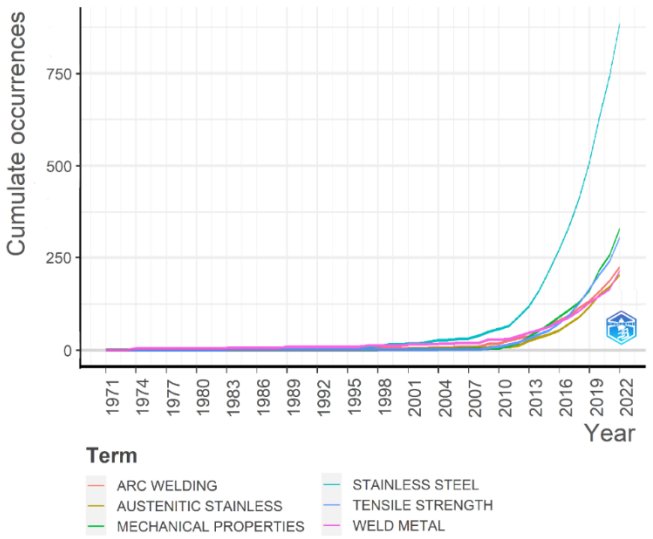

Figure 7. Growth of words used in dissimilar welding Stainless Steel-Carbon Steel

Table 5 and Figure 8 show the nations that contributed the most to the research. Biblioshiny's data analysis indicates that China is the highest-producing nation, with 190 articles. There are 19 works on international collaboration and 171 on internal cooperation. Iran and India have 68 and 146 articles, respectively, after China. Iran and India have 68 and 146 articles, respectively, after China. Cooperation between the two nations comprises 16 and 14 instances of international cooperation and 130 and 54 instances of domestic cooperation, respectively. Figure 9 depicts a map-like representation of the spread of state cooperation. On the globe, a dark-blue sign represents the degree of cooperative development intensity in each nation.

Table 5. The published articles and collaboration by country.

No	Country	Articles	Intra Country Collaboration	Inter Country Collaboration	Total Citation	Average Article Citations
1	China	190	171	19	3027	15.93
2	India	146	130	16	2022	13.85
3	Iran	68	54	14	1702	25.03
4	Turkey	33	31	2	816	24.73
5	Usa	25	18	7	696	27.84
6	Korea	22	21	1	315	14.32
7	United Kingdom	14	13	1	1243	88.79
8	Malaysia	13	6	7	79	6.08
9	Brazil	12	10	2	31	2.58
10	Japan	11	9	2	201	18.27

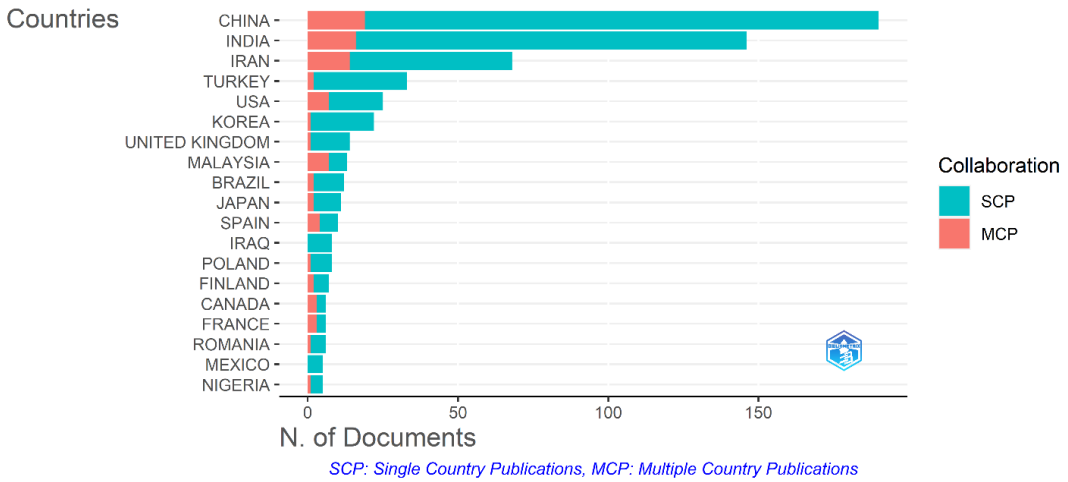

Figure 8. Corresponding author's country and intra-country collaboration (green); inter-country collaboration (orange).

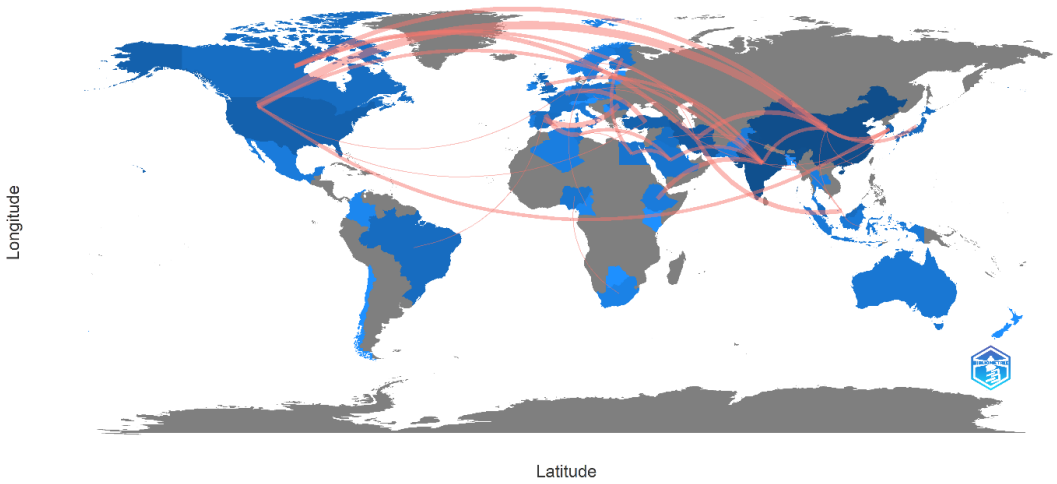

Figure 9. World map of collaboration.

Their H-index may explain the ranking of journals as research data providers [40]. The journal with the highest score in Table 6 is Material and Design, with an H index of 25. Despite having just 33 articles, this publication has 1832 citations. The International Journal of Advanced Manufacturing Technology and the Journal of Manufacturing Processes are the subsequent publications. Articles 18 and 43 in both publications have the same h index. The difference between the two is the number of citations, which is 833 and 928. This research also demonstrates that journals that begin publishing earlier cannot be cited as the most influential sources.

Table 6. Source notes for journals in the field of dissimilar welding Stainless Steel-Carbon Steel

No.	Journal	H-index	Total Citation	Number of Publication	Publication Year_start
1	Materials And Design	25	1832	33	2004
2	International Journal of Advanced Manufacturing Technology	18	833	43	2009
3	Journal of Manufacturing Processes	18	928	43	2014
4	Journal of Materials Processing Technology	14	535	18	2011
5	Materials Science and Engineering A	13	674	25	2010
6	Journal Of Materials Engineering and Performance	12	413	41	2006
7	Optics and Laser Technology	12	496	16	2008
8	Science And Technology of Welding and Joining	12	266	15	1997
9	Materials and Manufacturing Processes	8	200	10	2003
10	Metals	8	203	21	2016

China has published the most research articles on dissimilar welding between stainless steel and carbon steel. That is also shown in Figure 9, which depicts the author's effect analysis-based depiction of cooperation regions. Table 7 lists the most influential writers of this work. The Data presents the study's most-cited authors and papers. The Scopus database reveals that Threadgilll et al. (2009) have received 893 citations from influential writers. Cam (2011) was ranked as the second most influential author. This author has been cited 382 times, according to our data.

Table 7. Most impactful articles by the number of citations.

No.	Title	Authors Year	Total Citations	Citation per Year	Ref
1	Friction stir welding of aluminium alloys	Threadgilll et al. 2009	893	63.79	[41]
2	Friction stir welded structural materials: Beyond Al-alloys	Cam 2011	382	31.83	[42]
3	Investigation on AISI 304 austenitic stainless steel to AISI 4140 low alloy steel dissimilar joints by gas tungsten arc, electron beam and friction welding	Arivazhagan et al. 2011	201	16.75	[43]
4	Using Taguchi method to optimize welding pool of dissimilar laser-welded components	Anawa et al. 2008	166	11.07	[44]
5	Characterization of microstructure, mechanical properties and corrosion resistance of dissimilar welded joint between 2205 duplex stainless steel and 16MnR	Wang et al. 2011	135	11.25	[45]
6	Study on microstructure and mechanical characteristics of low-carbon steel and ferritic stainless-steel joints	Sarkari Khorrami et al. 2014	113	12.56	[46]
7	Brazability of dissimilar metals tungsten inert gas butt welding–brazing between aluminum alloy and stainless steel with Al–Cu filler metal	Lin et al. 2010	111	8.54	[47]
8	Effect of heat input on microstructure and mechanical properties of dissimilar joints between	Sadeghian et al. 2014	107	11.89	[48]

No.	Title	Authors Year	Total Citations	Citation per Year	Ref
	super duplex stainless steel and high strength low alloy steel				
9	Macrosegregation in dissimilar-metal fusion welding	Soysal et al. 2016	103	14.71	[49]
10	Microstructure and mechanical properties of AISI 347 stainless steel/A335 low alloy steel dissimilar joint produced by gas tungsten arc welding	Hajiannia et al. 2013	100	10.00	[50]

The development of dissimilar welding between stainless steel and carbon steel is shown in Figure 10 by dividing the two eras. Between 1971 and 2012, a bibliometric study was conducted during the first phase. The second era comprises the theme's evolution from 2013 and 2022. The research findings indicated that microstructure is the subject of further discussion. In addition, the trend in 2022 reveals that welding is still an important study area. Table 4's top term in this analysis is stainless steel; however, the material utilized in 2022 is carbon steel.

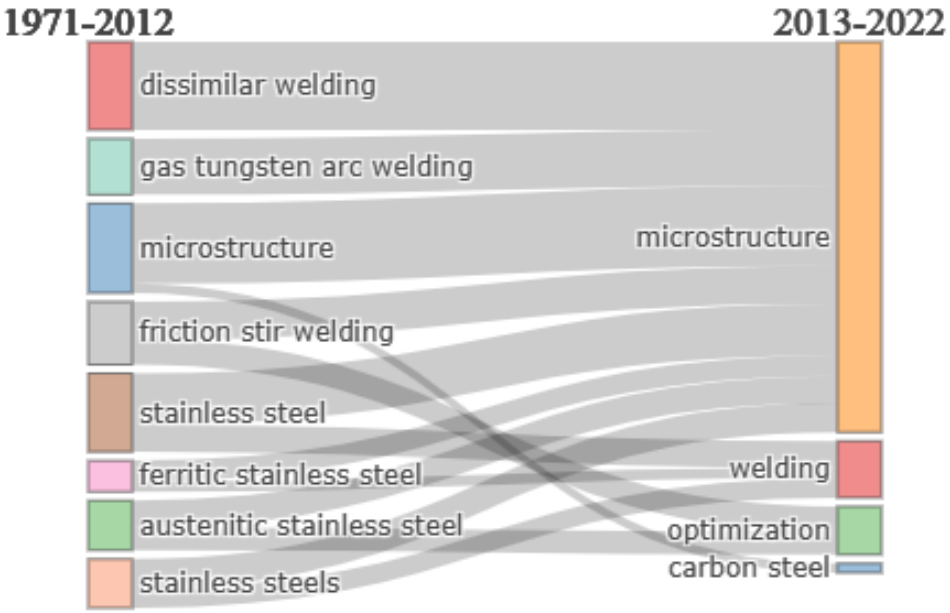

Figure 10. The evolution of the theme in two parts of the time span.

Figure 10's second period is then evaluated using Biblioshiny software. In 2020, mechanical characteristics were the most discussed subject. This research also indicates that the tendency to address mechanical characteristics will continue until 2022. Figure 11 depicts several popular subjects in specific years. In 2019, stainless steel became the

most popular subject. These findings also indicate that numerous more topics need further investigation. According to current studies, arc welding remains the optimum option for dissimilar welding between stainless steel and carbon steel.

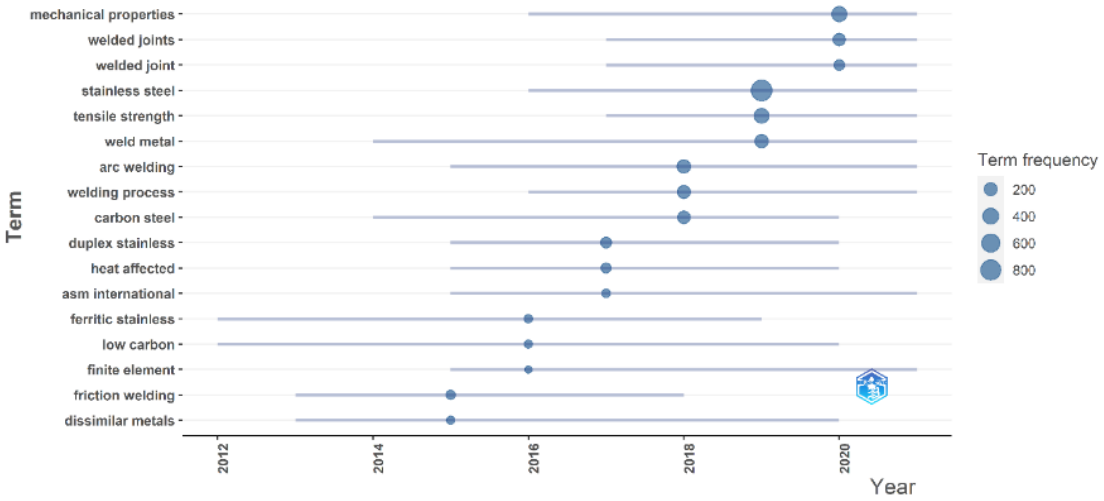

Figure 11. Topic trends in dissimilar welding Stainless Steel-Carbon Steel

The outcomes of this analysis should contribute to the development of the research. The information gathered helps the reader locate relevant sources for study on dissimilar welding of stainless steel and carbon steel. The progression of themes and topic trends indicates that mechanical property testing is this study's most frequently mentioned subject. Testing of mechanical characteristics relates primarily to the measurement of tensile strength. Arc welding is a subject that has yet to be explicitly addressed in this research. In the tree map analysis, only GMAW and GTAW appear as distinct forms of arc welding; therefore, there is still room for investigating alternative welding techniques.

4. Conclusion

A descriptive study has already been conducted, taking into account the author's dominance, the author's use of keywords, the author's impact in the area, and the author's worldwide and regional cooperation. According to the study's findings, there are no substantial discrepancies between the analytical conclusions and the data in the Scopus database. That demonstrates that the two apps employed, Biblioshiny and VOSviewer, can effectively evaluate data. The analysis outcomes vary in the analysis feature using a visual word cloud and a tree map. The table's data may be displayed in order to accommodate these discrepancies.

Shamanian, M from Isfahan University of Technology, Isfahan 84156-83111, Iran has 18 publications and is the most prolific author in this study. Shamanian, M. is not the most influential author despite having produced the most works. Data analysis indicates that Threadgill, PL, who owns the work Friction Stir Welding Of Aluminum Alloys, is the most influential author. This article was published in 2009 and received 893 citations, with an annual average of 63.79 citations. China is the dominating nation in terms of the number of articles published, including local and international co-authorship, according to an analysis of the nation.

The final findings of this examination may be used as a starting point for additional study. Generally, stainless steel or carbon steel is divided into groups based on its

fundamental elements. That affords excellent possibilities to do research utilizing a range of sources. The research also revealed that welding methods, such as SMAW in arc welding, were not explored in detail. That provides prospects for study into dissimilar SMAW welding. Many elements within SMAW, such as welding groove, electrode type and diameter, welding polarity, and welding current, may be used using the SMAW technique.

References

[1] D. Wallerstein *et al.*, "Dissimilar unbeveled butt joints of AA6061 to S235 structural steel by means of standard single beam fiber laser welding-brazing," *J Mater Process Technol*, vol. 291, 2021, doi: https://doi.org/10.1016/j.jmatprotec.2020.116994

[2] I. Bunaziv, O. M. Akselsen, X. Ren, B. Nyhus, M. Eriksson, and S. Gulbrandsen-Dahl, "A Review on Laser-Assisted Joining of Aluminium Alloys to Other Metals," *Metals (Basel)*, vol. 11, no. 11, p. 1680, Oct. 2021, doi: https://doi.org/10.3390/met11111680.

[3] M. Werner *et al.*, "New lightweight construction prospects enabled by hydroforming," in *MATEC Web of Conferences*, EDP Sciences, Aug. 2015. doi: https://doi.org/10.1051/matecconf/20152106004.

[4] R. Chaudhari, P. K. Loharkar, and A. Ingle, "Applications and challenges of arc welding methods in dissimilar metal joining," in *IOP Conference Series: Materials Science and Engineering*, Institute of Physics Publishing, Apr. 2020. doi: https://doi.org/10.1088/1757-899X/810/1/012006.

[5] D. K. Gope and S. Chattopadhyaya, "Dissimilar Welding of Nickel Based Superalloy with Stainless Steel: Influence of Post Weld Heat Treatment," *Materials and Manufacturing Processes*, vol. 37, no. 2, pp. 136–142, 2022, doi: https://doi.org/10.1080/10426914.2021.1945095.

[6] S. Sorrentino, "Welding technologies for ultra-supercritical power plant materials," in *Materials for Ultra-Supercritical and Advanced Ultra-Supercritical Power Plants*, Elsevier Inc., 2017, pp. 247–319. doi: https://doi.org/10.1016/B978-0-08-100552-1.00009-9.

[7] P. Kah and M. S. Jukka Martikainen, "Trends in joining dissimilar metals by welding," in *Applied Mechanics and Materials*, 2013, pp. 269–276. doi: https://doi.org/10.4028/www.scientific.net/AMM.440.269.

[8] G. M. Slaughter and D. A. Canonico, "Welding And Brazing Filler Metals," *NUCLEAR ENGINEERING AND DESIGN*, vol. 17, pp. 181–203, 1971, doi: https://doi.org/10.1016/0029-5493(71)90023-9.

[9] K. Karthick, S. Malarvizhi, V. Balasubramanian, S. A. Krishnan, G. Sasikala, and S. K. Albert, "Tensile and impact toughness properties of various regions of dissimilar joints of nuclear grade steels," *Nuclear Engineering and Technology*, vol. 50, no. 1, pp. 116–125, Feb. 2018, doi: https://doi.org/10.1016/j.net.2017.10.003.

[10] I. A. Pahlawan, A. A. Arifin, E. Marliana, and H. Irawan, "Effect of welding electrode variation on dissimilar metal weld of 316l stainless steel and steel ST41," in *IOP Conference Series: Materials Science and Engineering*, IOP Publishing Ltd, Jan. 2021. doi: https://doi.org/10.1088/1757-899X/1010/1/012001.

[11] A. Aghaei Chadegani *et al.*, "A comparison between two main academic literature collections: Web of science and scopus databases," *Asian Soc Sci*, vol. 9, no. 5, pp. 18–26, Apr. 2013, doi: https://doi/org/10.5539/ass.v9n5p18.

[12] W. Mengist, T. Soromessa, and G. Legese, "Ecosystem services research in mountainous regions: A systematic literature review on current knowledge and research gaps," *Science of the Total Environment*, vol. 702. Elsevier B.V., Feb. 01, 2020. doi: https://doi.org/10.1016/j.scitotenv.2019.134581.

[13] A. C. Garcia and C. Ordonez, "Keyword Search Across Database And Documents," 2010.

[14] Y. Qian and H. Han Wang, "Frontier Dynamic Research on China's three Rural Financial Development under the Background of Inclusive Finance: Based on Bibliometric Analysis," in *E3S Web of Conferences*, EDP Sciences, Feb. 2021. doi: https://doi.org/10.1051/e3sconf/202123501045.

[15] B. A. Muritala, M. V. Sánchez-Rebull, and A. B. Hernández-Lara, "A bibliometric analysis of online reviews research in tourism and hospitality," *Sustainability (Switzerland)*, vol. 12, no. 23. MDPI, pp. 1–18, Dec. 01, 2020. doi: https://doi.org/10.3390/su12239977.

[16] L. Ali, F. Alnajjar, W. Khan, M. A. Serhani, and H. al Jassmi, "Bibliometric Analysis and Review of Deep Learning-Based Crack Detection Literature Published between 2010 and 2022," *Buildings*, vol. 12, no. 4. MDPI, Apr. 01, 2022. doi: https://doi.org/10.3390/buildings12040432.

[17] M. White, "Sample size in quantitative instrument validation studies: A systematic review of articles published in Scopus, 2021," *Heliyon*, vol. 8, no. 12. Elsevier Ltd, Dec. 01, 2022. doi: https://doi.org/10.1016/j.heliyon.2022.e12223.

[18] U. Ubaidillah, B. W. Lenggana, and S. B. Choi, "Bibliometric Review of Magnetorheological Materials," *Sustainability (Switzerland)*, vol. 14, no. 23. MDPI, Dec. 01, 2022. doi: https://doi.org/10.3390/su142315816.

[19] H. T. Kim and S. C. Kil, "Scientometric analysis of multifunctional flux cored welding wire," in *Asian Journal of Chemistry*, Chemical Publishing Co., 2013, pp. 5724–5726. doi: https://doi.org/10.14233/ajchem.2013.OH73.

[20] H. Alves, C. Fernandes, and M. Raposo, "Social Media Marketing: A Literature Review and Implications," *Psychol Mark*, vol. 33, no. 12, pp. 1029–1038, Dec. 2016, doi: https://doi.org/10.1002/mar.20936.

[21] M. N. Hudha, I. Hamidah, A. Permanasari, A. G. Abdullah, I. Rachman, and T. Matsumoto, "Low carbon education: A review and bibliometric analysis," *European Journal of Educational Research*, vol. 9, no. 1. Eurasian Society of Educational Research, pp. 319–329, 2020. doi: 10.12973/eu-jer.9.1.319.

[22] Y. Chen *et al.*, "A bibliometric analysis for the research on laser processing based on Web of Science," *J Laser Appl*, vol. 32, no. 2, p. 022001, May 2020, doi: https://doi.org/10.2351/1.5097739.

[23] M. S. Yin, "Fifteen years of grey system theory research: A historical review and bibliometric analysis," *Expert Systems with Applications*, vol. 40, no. 7. pp. 2767–2775, Jun. 01, 2013. doi: https://doi.org/10.1016/j.eswa.2012.11.002.

[24] F. M. Mwema, T. C. Jen, and P. Kaspar, "Fractal Theory in Thin Films: Literature Review and Bibliometric Evidence on Applications and Trends," *Fractal and Fractional*, vol. 6, no. 9. MDPI, Sep. 01, 2022. doi: https://doi.org/10.3390/fractalfract6090489.

[25] M. de Miguel Molina, V. Santamarina Campos, M. Á. Carabal Montagud, and B. de Miguel Molina, "Ethics for civil indoor drones: A qualitative analysis," *International Journal of Micro Air Vehicles*, vol. 10, no. 4, pp. 340–351, Dec. 2018, doi: https://doi.org/10.1177/1756829318794004.

[26] V. García-Pascual, E. García-Beltrán, and B. Domenech-Amigot, "Eye-Related COVID-19: A Bibliometric Analysis of the Scientific Production Indexed in Scopus," *Int J Environ Res Public Health*, vol. 19, no. 16, Aug. 2022, doi: https://doi.org/10.3390/ijerph19169927.

[27] L. Yin *et al.*, "Investigation on Corrosion Resistance of Welded Cu-Bearing 304L Stainless Steel Against Pseudomonas aeruginosa," *Front Mater*, vol. 7, Jun. 2020, doi: https://doi.org/10.3389/fmats.2020.00102.

[28] P. Layus *et al.*, "Big Data bibliometric research of welding scientific publication in 10 years period," in *Proceedings of 20th International Conference*, Mechanika, 2015. [Online]. Available: https://www.researchgate.net/publication/280575749

[29] Y. Yang *et al.*, "Research progress on the microstructure and mechanical properties of friction stir welded Al–Li alloy joints," *Journal of Manufacturing Processes*, vol. 82. Elsevier Ltd, pp. 230–244, Oct. 01, 2022. doi: https://doi.org/10.1016/j.jmapro.2022.07.067.

[30] F. Iman, B. N. Benyamin, and A. F. C. Mohammad, "A bibliometric analysis on friction stir welding," *China Welding (English Edition)*, vol. 30, no. 3, pp. 39–48, Sep. 2021, doi: 10.12073/j.cw.20210613001.

[31] Dennis. Shasha, J. T. L. Wang, Association for Computing Machinery., Association for Computing Machinery. Special Interest Group on Management of Data., and ACM Digital Library., "CSV : Visualizing and Mining Cohesive Subgrapha," Association for Computing Machinery, 2008, p. 1378.

[32] I. N. P. W. Dharmawan and R. Sarno, "Book recommendation using Neo4j graph database in BibTeX book metadata," 2017 3rd International Conference on Science in Information Technology (ICSITech), Bandung, Indonesia, 2017, pp. 47-52, doi: 10.1109/ICSITech.2017.8257084.

[33] D. Guleria and G. Kaur, "Bibliometric analysis of ecopreneurship using VOSviewer and RStudio Bibliometrix, 1989–2019," *Library Hi Tech*, vol. 39, no. 4, pp. 1001–1024, 2021, doi: https://doi.org/10.1108/LHT-09-2020-0218.

[34] M. Aria and C. Cuccurullo, "bibliometrix: An R-tool for comprehensive science mapping analysis," *J Informetr*, vol. 11, no. 4, pp. 959–975, Nov. 2017, doi: https://doi.org/10.1016/j.joi.2017.08.007.

[35] M. Gutiérrez-Salcedo, M. Á. Martínez, J. A. Moral-Munoz, E. Herrera-Viedma, and M. J. Cobo, "Some bibliometric procedures for analyzing and evaluating research fields," *Applied Intelligence*, vol. 48, no. 5, pp. 1275–1287, May 2018, doi: https://doi.org/10.1007/s10489-017-1105-y.

[36] J. Md Khudzari, J. Kurian, B. Tartakovsky, and G. S. V. Raghavan, "Bibliometric analysis of global research trends on microbial fuel cells using Scopus database," *Biochem Eng J*, vol. 136, pp. 51–60, Aug. 2018, doi: https://doi.org/10.1016/j.bej.2018.05.002.

[37] J. Kangazian, M. Shamanian, and A. Ashrafi, "Dissimilar welding between SAF 2507 stainless steel and Incoloy 825 Ni-based alloy: The role of microstructure on corrosion behavior of the weld metals," *J Manuf Process*, vol. 29, pp. 376–388, Oct. 2017, doi: https://doi.org/10.1016/j.jmapro.2017.08.012.

[38] M. Sadeghian, M. Shamanian, and A. Shafyei, "Effect of heat input on microstructure and mechanical properties of dissimilar joints between super duplex stainless steel and high strength low alloy steel," *Mater Des*, vol. 60, pp. 678–684, 2014, doi: https://doi.org/10.1016/j.matdes.2014.03.057.

[39] Z. Mo, H. Z. Fu, and Y. S. Ho, "Highly cited articles in wind tunnel-related research: a bibliometric analysis," *Environmental Science and Pollution Research*, vol. 25, no. 16, pp. 15541–15553, Jun. 2018, doi: https://doi.org/10.1007/s11356-018-1766-z.

[40] S. Alonso, F. J. Cabrerizo, E. Herrera-Viedma, and F. Herrera, "h-Index: A review focused in its variants, computation and standardization for different scientific fields," *Journal of Informetrics*, vol. 3, no. 4. pp. 273–289, Oct. 2009. doi: https://doi.org/10.1016/j.joi.2009.04.001.

[41] P. L. Threadgilll, A. J. Leonard, H. R. Shercliff, and P. J. Withers, "Friction stir welding of aluminium alloys," *International Materials Reviews*, vol. 54, no. 2, pp. 49–93, 2009, doi: https://doi.org/10.1179/174328009X411136.

[42] G. Çam, "Friction stir welded structural materials: Beyond Al-alloys," *International Materials Reviews*, vol. 56, no. 1, pp. 1–48, 2011, doi: https://doi.org/10.1179/095066010X12777205875750.

[43] N. Arivazhagan, S. Singh, S. Prakash, and G. M. Reddy, "Investigation on AISI 304 austenitic stainless steel to AISI 4140 low alloy steel dissimilar joints by gas tungsten arc, electron beam and friction welding," *Mater Des*, vol. 32, no. 5, pp. 3036–3050, 2011, doi: https://doi.org/10.1016/j.matdes.2011.01.037.

[44] E. M. Anawa and A. G. Olabi, "Using Taguchi method to optimize welding pool of dissimilar laser-welded components," *Opt Laser Technol*, vol. 40, no. 2, pp. 379–388, 2008, doi: https://doi.org/10.1016/j.optlastec.2007.07.001.

[45] S. Wang, Q. Ma, and Y. Li, "Characterization of microstructure, mechanical properties and corrosion resistance of dissimilar welded joint between 2205 duplex stainless steel and 16MnR," *Mater Des*, vol. 32, no. 2, pp. 831–837, 2011, doi: https://doi.org/10.1016/j.matdes.2010.07.012.

[46] M. Sarkari Khorrami, M. A. Mostafaei, H. Pouraliakbar, and A. H. Kokabi, "Study on microstructure and mechanical characteristics of low-carbon steel and ferritic stainless steel joints," *Materials Science and Engineering A*, vol. 608, pp. 35–45, 2014, doi: https://doi.org/10.1016/j.msea.2014.04.065.

[47] S. B. Lin, J. L. Song, C. L. Yang, C. L. Fan, and D. W. Zhang, "Brazability of dissimilar metals tungsten inert gas butt welding-brazing between aluminum alloy and stainless steel with Al-Cu filler metal," *Mater Des*, vol. 31, no. 5, pp. 2637–2642, 2010, doi: https://doi.org/10.1016/j.matdes.2009.12.005.

[48] M. Sadeghian, M. Shamanian, and A. Shafyei, "Effect of heat input on microstructure and mechanical properties of dissimilar joints between super duplex stainless steel and high strength low alloy steel," *Mater Des*, vol. 60, pp. 678–684, 2014, doi: https://doi.org/10.1016/j.matdes.2014.03.057.

[49] T. Soysal, S. Kou, D. Tat, and T. Pasang, "Macrosegregation in dissimilar-metal fusion welding," *Acta Mater*, vol. 110, pp. 149–160, 2016, doi: https://doi.org/10.1016/j.actamat.2016.03.004.

[50] I. Hajiannia, M. Shamanian, and M. Kasiri, "Microstructure and mechanical properties of AISI 347 stainless steel/A335 low alloy steel dissimilar joint produced by gas tungsten arc welding," *Mater Des*, vol. 50, pp. 566–573, 2013, doi: https://doi.org/10.1016/j.matdes.2013.03.029