Systematic Review on Carbon Reinforced Plastics

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Abstract

Carbon Reinforced Plastics/polymers are metamaterials, widely used for diversified purposes for their unique features. The Review analysis had been conducted to understand the active authors, organizations, journals, and countries involved in the research domain of "Carbon Reinforced Plastics". All published articles related to "Carbon Reinforced Plastics" from "Scopus", were analyzed using the Meta Analysis to develop analysis tables and visualization maps. This article had set the objective to consolidate the scientific literature regarding the "Carbon Reinforced Plastics" and also to find out the trends related to the same. The most active journals in this research domain were Mechanics of Composite Materials, Journal of Materials Processing Technology, and Applied Mechanics Reviews. The most active countries were China, Japan, Portugal, and the United Kingdom. The leading organizations engaged in the research regarding Carbon Reinforced Plastics were the University of Tokyo of Japan, the Russian Academy of Sciences of Russia, and the Ministry of Education of China. The most active authors who had made valuable contributions related to Carbon Reinforced Plastics were Yates B. Davim J.P.Reis P. And Ishikawa T.

Keywords: Metamaterial, Carbon Reinforced Plastics, Review analysis, Meta Analysis,

1. Introduction

Metamaterials are engineered or composite materials with special or extra features than natural [1], [2]materials. Carbon fiber reinforced plastics/polymers are metamaterials, widely used for diversified purposes for their unique features, especially their strength[3], stiffness, and lightweight structure [4][5][6]. Carbon fiber-based plastics are widely used in aviation and aerospace [7]; automobiles, shipbuilding[8], machine building, etc[9]. Optimum production conditions are essential for the production of good quality carbon fiber reinforced plastics, otherwise leads to dilution in quality[5][6]. The other features of Carbon fiber reinforced plastics include, high specific tensile strength, high modulus, easy process ability, recycling convenience, and outstanding wear resistance [7]. Carbon fiber reinforced plastics is an important research niche in material engineering[10]. This article points out the need for future research regarding Carbon fiber reinforced plastics[11]. This Review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Carbon fiber reinforced plastics. This Review article is arranged in four sections. The first section is the introduction, followed by the discussion of the methodology by which the research was conducted. The third section deals with results and discussion. The fourth section deals with the conclusion.

1.1 Research Objectives

a) To consolidate the literature regarding the Carbon Reinforced Plastics
b) To find out the trends related to research in the Carbon Reinforced Plastics

The following research questions are framed for conducting Review analysis systematically.

1.2 Research Questions

a) Who are the active researchers working on Carbon Reinforced Plastics?
b) Which are the main organizations and countries working on Carbon Reinforced Plastics?
c) Which are the main journals related to Carbon Reinforced Plastics?

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE (Carbon Reinforced Plastics). All the tables in this paper were created by using Microsoft Excel and Meta Analysis. Grammarly was used for spelling and grammar checks. Mendeley was used for article review and citation.This paper had been inspired by Review analysis in its presentation style, analysis, and methodology from the works.

3. Results and discussion

3.1 Results

This first round of search produced an outcome of 1723 documents, in twelve languages, out of which 1461 documents were in English. The classification of document categories is shown in Table 1. For improving the quality of the analysis, we had selected only the peer-reviewed articles and all other documents had not been considered. Thus after using filters "Article" and "English" the second round search produced an outcome of 976 English articles (both open access and others) and had been used to conduct Review analysis and visualization using Meta Analysis. The English research articles in this domain since 1968 had been shown in Table1.Co-authorship analysis of top authors had been shown in Table 3. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as six and the minimum number of citations of authors as one. This combination plotted the map of 30 authors, in 14 clusters. The overlay visualization map of co-authorship analysis plotted in Table3, points out the major researchers with their strong co-authorship linkages and clusters involved. The citation analysis of top authors had been shown in table 1, along with co-authorship links. For the citation analysis, the parameters used werethe minimum number of documents of an author as one and the minimum citations of an author as one.

Table 1: Highlights of most active authors

Description	Authors	Documents	Citations	Average citations per documents	Link strength
Authors with the highest publication	Yates B.	12	276	23	51
Authors with the highest citation	Davim J.P.	9	1552	172.44	27
Authors with the highest average citation	Reis P.	3	797	265.67	3
Authors with the highest co-authorship links	Ishikawa T.	7	16	2.29	55

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as30. This combination plotted the map of 42 thresholds, in four clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Carbon Reinforced Plastics" had been found out by the volume of publications and citation analysis, the parameters used are the minimum number of documents of an organization as one and the minimum number of citations of organizations as one. The leading organization in the research regarding "Carbon Reinforced Plastics", with the highest number of publications and citations, were the University of Tokyo of Japan, the Russian Academy of Sciences of Russia, and the Ministry of Education of China(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document	H-Index
The University of Tokyo	Japan	27	590	21.9	13
Russian Academy of Sciences	Russia	26	41	1.5	03
Ministry of Education	China	25	196	7.8	07

Co-authorship analysis of the countries engaged in the research on "Carbon Reinforced Plastics" had been shown in Table3. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as ten and the minimum number of citations of authors as one. This combination plotted the map of 16 countries, five clusters. The overlay visualization map of co-authorship analysis plotted in Table3, points out the main countries with their strong co-authorship linkages and clusters involved. The citation analysis of top countries had been shown in table 3, along with co-authorship links. For the citation analysis, the parameters used were the minimum number of documents of a country as one and the minimum citations of the country as one.

Table 3: Highlights of Active Countries

Description	Country	Documents	Citations	Average citations per documents	Link strength
The country with the highest publication	Japan	194	2630	13.5567	29
The country with the highest co-authorship links	China	165	1605	9.727273	42
The country with the highest citations	United Kingdom	107	3877	36.23364	22
The country with the highest average citations	Portugal	10	1552	155.2	7

The most active countries in this research domain were China, Japan, Portugal, and the United Kingdom with the highest number of co-authorship links, publications, average citations, and citations respectively.

Link analysis and citation analysis were used to identify the most active journal in this research domain. We have taken the parameters of the minimum number of documents of a journal as one and the minimum number of citations of a journal as one for the link analysis and citation analysis. Highlights of the most active and relevant journals related to the "Carbon Reinforced Plastics" are shown in table 4. Table 4shows the journal activity of this research domain through parameters of publication volume, citations, and co-authorship linkages. Mechanics of Composite Materials was the most active journal with the highest publications; Journal of Materials Processing Technology with the highest co-authorship, and citations. The leading journal with the highest average citation is Applied Mechanics Reviews

Table 4: Analysis of journal activity

Description	Journal details	Documents	Citations	Average citations per documents	Link strength
Journal with the highest publications	Mechanics of Composite Materials	50	64	1.28	6
Journal with the highest average citation	Applied Mechanics Reviews	1	179	179	1
Journal with the highest citations, and co-authorship links	Journal of Materials Processing Technology	13	1027	79	78

From the above discussion regarding the Review patterns in the research regarding the Carbon Reinforced Plastics,this research had observed a gradual increase in research interest regarding the Carbon Reinforced Plasticsfrom the starting of the millennium and the momentum is going on positively. This points out the relevance and potential of this research domain (Refer to Table 2).The most active authors in this research domain were Yates B.Davim J.P.Reis P.Ishikawa T. with the highest publication, citations, average citation, and co-authorship links respectively (Refer to table 1).The overlay analysis of top countries researching Carbon Reinforced Plastics indicates that China, Japan, Portugal, and United Kingdom were the leading country in research regarding Carbon Reinforced Plastics with the highest publications, citations, and co-authorship links(Refer to Table 5). The top journals of this research domain were identified as Mechanics of Composite Materials, Journal of Materials Processing Technology. The leading journal with the highest average citation is Applied Mechanics Reviews. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Carbon Reinforced Plastics.

4. Conclusion

Carbon Reinforced Plasticsis an interesting research domain and the most active journals related to this research domain are Mechanics of Composite Materials, Journal of Materials Processing Technology. The leading journal with the highest average citation is Applied Mechanics Reviews. The most active countries were China, Japan, Portugal, and the United Kingdom. The leading organizations engaged in the research regarding Carbon Reinforced Plastics were the University of Tokyo of Japan, the Russian Academy of Sciences of Russia, and the Ministry of Education of China. The most active authors who had made valuable contributions related to Carbon Reinforced Plastics were Yates B.Davim J.P.Reis P.Ishikawa T.This research domain offers a new avenue for researchers and future research can be on Metamaterial and Carbon Reinforced Plastics.

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