

# An investigation of Corrosion of Platinum-Implants

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## Abstract

Platinum is one of the most used metals for implants. There view analysis had been conducted to understand the active authors, organizations, journals, and countries involved in the research domain of “Corrosion of Platinum-implants”. All published articles related to “Corrosion of Platinum-implants” 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 “Corrosion of Platinum-implants” and also to find out the trends related to the same. The leading Journals were the Journal of Neural Engineering and Journal of Bio-Medical Materials research: part B Applied Biomaterials. The most active country was the United States of America. The leading organization engaged in the research regarding Platinum-implants was the University of Melbourne, Australia. The most active authors who had made valuable contributions related to Platinum-implants were Hassler C, Ruther P, Stieglitz, and Von Metzen R.P and Shepherd R.K.

**Keywords:** Corrosion, Platinum-implants, Material engineering, Review analysis, Meta Analysis,

## 1. Introduction

An engineered medical device to replace a missing or damaged biological structure is known as an implant. Different types of metals and materials are used to create implants. Platinum had been used for diversified purposes. Corrosion is a serious issue concerning platinum implants.

Platinum metal is being widely used in breast implants, especially as catalysts in Silicon-based breast implants (Maharaj, 2008). The health issues associated with the usage of Platinum among women using Silicone breast implants had been highlighted (Maharaj, 2007)(Maharaj, 2004). There are concerns over allergic reaction of platinum in breast implants and the high metal content in body fluids, tissues, and explants (Lykissa and Maharaj, 2006b)(Lykissa and Maharaj, 2006a). There are also concerns associated with platinum implants and urinary platinum (Nuttall, Gordon and Ash, 1994). (Schierl *et al.*, 2014). However no published records are highlighting the allergic reactions of platinum among women with breast implants (Arepalli, Bezabeh and Brown, 2002); the comments regarding high platinum concentration are not backed by experimental studies(Lane, 2006)(Brook, 2006)(Wixtrom, 2007).The platinum metal had been used for cochlear implants (Durisin *et al.*, 2014)(Eisenberg *et al.*, 2000). Similarly, platinum is also used for dental implants (Jacobs and Göttingen, 1974); Platinum implant in glaucoma surgery (Muldoon, Ripple and Wilder, 1951); eyelid implants based on platinum (Schrom *et al.*, 2005). One added advantage is the survival of platinum filaments used as bioimplants in environments with high electromagnetic waves (Tartière, Courtheoux and Bureau, 2002).

Material engineering and surface engineering can play a significant role in improving the performance and life of Platinum–implants along with measures for reducing toxicity and hypersensitivity of the metal implants. Future research can also be on surface coatings by using, metal implants using Platinum. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Platinum-implants.

This article is arranged into 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. The following research objectives and research questions were framed for conducting review analysis systematically.

### 1.1 Research Objectives

- a) To consolidate the literature regarding corrosion of Platinum-implants
- b) To find out the trends related to research in corrosion of Platinum-implants

### 1.2 Research Questions

- a) Who are the active researchers working on corrosion of Platinum-implants?
- b) Which are the main organizations and countries working on corrosion of Platinum-implants?
- c) Which are the main journals on corrosion of Platinum-implants?

## 2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Corrosion Platinum-implant). 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 84 documents, in three languages, out of which 82 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 62 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 1973 had been shown in Table 1. Co-authorship analysis of top authors had been shown in Table 1. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as two and the minimum number of citations of authors as one. This combination plotted the map of 19 authors, in five clusters. The overlay visualization map of co-authorship analysis plotted in Table 1, 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 were the 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 and co-authorship links	Shepherd R.K	7	48	7	40
Authors with the highest citations	Hassler C	1	166	166	3
	Ruther P	1	166	166	3
	Stieglitz T.	1	166	166	3
	Von Metzen R.P	1	166	166	3

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as 10. This combination plotted the map of 22 thresholds, in three clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table 2. The leading organizations engaged in research on “corrosion of Platinum-implants” 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 organizations in the research regarding “corrosion of Platinum-implants”, with the highest number of publications and citations, were the University of Melbourne, Australia (Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
University of Melbourne	Australia	11	117	10.6

Co-authorship analysis of the countries engaged in the research on “corrosion Platinum-implants” had been shown in Table 3. The overlay visualization map of co-authorship analysis plotted in Table 3, 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	Link strength
The country with the leading publication, citations, and co-authorship links	United States of America	18	651	3

The most active country in this research domain was the United States of America, with the leading number of publications, links, and citations.

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 “corrosion of Platinum-implants” are shown in table 4. Table 4 shows the journal activity of this research domain through parameters of publication volume, citations, and co-authorship linkages.

Table 4: Analysis of journal activity

Description	Journal details	Documents	Citations	Average citations per documents	Links
Journal with the highest publications	Journal of Neural Engineering	7	97	14	7
Journal with highest citations	Journal of Bio-Medical Materials research: part B Applied Biomaterials	1	166	166	0

From the above discussion regarding the review patterns in the research regarding corrosion Platinum-implants, Sthis research had observed a gradual increase in research interest regarding corrosion of Platinum-implants from 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 Shepherd R.K with the highest publication; and co-authorship links, and Hassler C, Ruther P, Stieglitz, and Von Metzen R.P with the highest citations(Refer to table 1).The overlay analysis of top countries researching corrosion of Platinum-implants indicates that the United States of America was the leading country relating to the publications, citations, and co-authorship links(Refer to Table 5). The top journals of this research domain were identified as the Journal of Neural Engineering and Journal of Bio-Medical Materials research: part B Applied Biomaterials. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding corrosion of platinum–implants.

#### 4. Conclusion

Corrosion of Platinum-implants was an interesting research domain and the most active journals related to this research domain were the Journal of Neural Engineering and Journal of Bio-Medical Materials research: part B Applied Biomaterials. The most active country was the United States of America. The leading organization engaged in the research regarding Platinum-implants was the University of Melbourne, Australia. The most active authors who had made valuable contributions related to Platinum-implants were Hassler C, Ruther P, Stieglitz, and Von Metzen R.P and Shepherd R.K. This research domain offers a new avenue for researchers and future research can be on innovations in corrosion of Platinum-implants.

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