

# Analysis on ESI Materials Science and Countermeasure Research Based on InCites and WOS at Normal Universities

—Taking Jiangxi Normal University as an Example

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**Abstract**—The paper reasonably selects main citation index of Jiangxi Normal University' ESI materials science based on InCites and Web of Science (WOS).Then makes analysis of paper output, impact, collaborating, contribution, source publication, comparison with ESI materials science threshold by statistics, bibliometrics and comparative research methods.Then makes conclusions which the output and quality of papers in materials science of Jiangxi Normal University have certain gap with the level of first-class international disciplines. And at last the author puts forward four feasible suggestions.

**Keywords**—InCites; WOS; ESI Materials Science; Bibliometrics; Citation Index

## I. INTRODUCTION

On October 24, 2015, the State Council issued the Overall Plan for Coordinating the Development of World-Class Universities and First-Class Disciplines, (hereinafter referred to as the Overall Plan), and according to the Overall Plan, by 2020, several universities and subjects are expected to leap into the front ranks of the world. From the data released by ESI on March 14, 2019, 12 institutions among China's teacher-training colleges have entered the world's top 1%, far higher than mathematics and physics. It is of great significance to let the manager of the teacher-training colleges understand the position, the development trend as well as the existing problems of the ESI materials science by statistics and bibliometrics method. Based on two databases InCites and WOS, this thesis takes Jiangxi Normal University as an example and reasonably selects its main citation indicators in ESI materials science, aiming to analyze paper output, paper impact, cooperation countries and institutions, contributing institutions and researchers, publication journals and comparison with ESI materials science threshold.And finally makes conclusion and proposes four feasible suggestion.

## II. ANALYSIS OF OUTPUT AND INFLUENCE OF OVERALL THESIS IN ESI MATERIALS SCIENCE

### A. Analysis of overall output and development trend of the thesis

In the InCites database, 340 ESI Materials Science papers of Jiangxi normal university were listed in seven index

database of WOS (including SCIE, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S and BKCI-SSH) in 2008-2018.As shown in Fig 1, we can see paper output remained at a slow growth with low volume in 2008-2011. But after 2012, the output of the paper showed a steady upward trend, from 22 in 2012 to 65 in 2018, and the rate of increase was relatively stable, with an growth of as high as 195% during seven years.

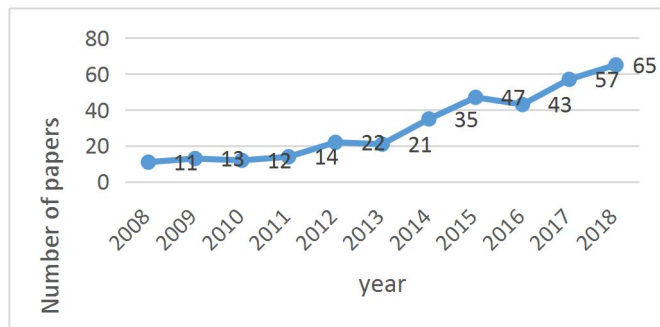


Fig. 1. Trend Chart of Jiangxi Normal University' ESI Materials Science Papers in 2008-2018

### B. Analysis of the thesis's overall and relative influence

An important way to measure the impact of scientific research is to analyze the citations of scientific and technological papers[1]. The times cited is an important index to reflect the quality of the paper. Generally speaking, the peak of times cited is the 2 to 4 years after publication. Professor Qiu Junping[2], working in Evaluation research center of Wuhan University researched on literature information citation rules and citation analysis method and then put forward that the best scientific literature cited years for Chinese literature is approximately 2 to 5 years after the publication, and for foreign literature is about 3 to 8 years.

Between 2008 and 2018, the times cited of ESI materials science of Jiangxi Normal University reached to 5382, and citation impact was 15.83, which was higher than the global baseline 15.46. All these indicate that the institution's paper output in materials science has exerted a large academic impact in the past decade.Because times cited is directly related to published year, the earlier paper is published, the more times cited it will get.In order to reflect more objectively the

academic influence of Jiangxi Normal University's papers published in Material Science, 5-Year Trend Graph is shown in Fig 2. Compared with the number of WOS papers, the times cited shows a straight upward trend, which indicates Jiangxi Normal University has made great progress in the development of materials science.

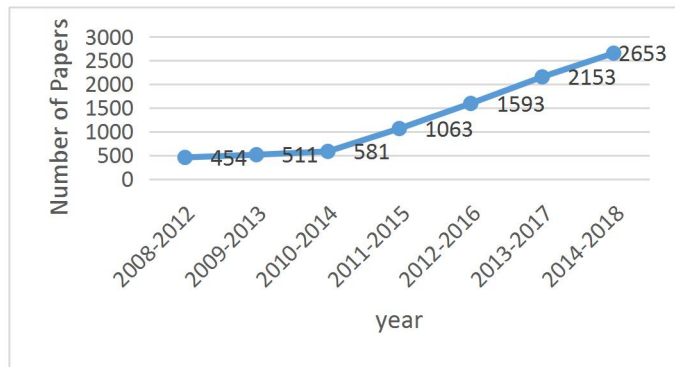


Fig. 2. 5-Year Trend Graph of Jiangxi Normal University' ESI Materials Science Papers Times Cited

In evaluating the impact of an institutional paper, two citation index (Times Cited and Citation Impact) have certain limitations without considering discipline, year, total paper output, paper type and other factors. Two quotation indicators of InCites database are introduced: Category Normalized Citation Impact (CNCI) and Journal Normalized Citation Impact(JNCI[3]. CNCI is a very valuable and objective impact indicator, which is not affected by the year of publication, subject area and type of literature. JNCI is similar to CNCI. The difference is that the JNCI is not standardized in the research field but is normalized on the number of cited times in specific journals. Now we will compared the global baseline 1 with two citation index of the Jiangxi Normal University' ESI materials science during the 2008-2018, which is shown in Fig. 3. According to the figure, We have found that its influence in ESI materials science in 2008-2018 is performing well, which is far above the global baseline 1 in most years. Only in 2010 and 2018 they were weak, and the quality of papers published in these two years was mediocre, especially in 2010, when CNCI was only 0.38.

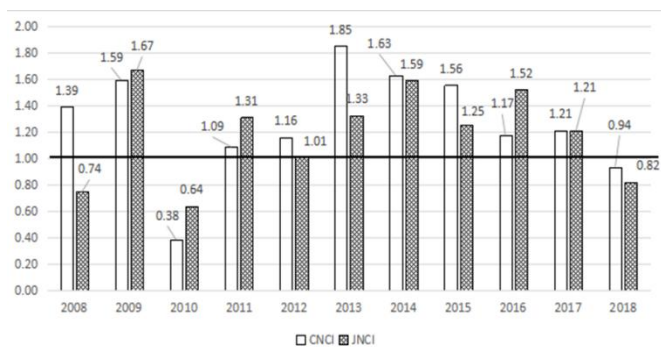


Fig. 3. CNCI and JNCI of Jiangxi Normal University' ESI Materials Science Papers in 2008-2018

### III. COLLABORATING INSTITUTIONS AND INFLUENCE ANALYSIS OF OUTPUT AND INFLUENCE IN ESI MATERIALS SCIENCE

A number of empirical studies have shown that the results of collaborative research have generally more citations than those completed independently[4]. By cooperating, we can spread our scientific research results to the world more quickly. Among the 340 ESI materials science papers published in 2008-2018, researchers of Jiangxi Normal University are in cooperation with 134 institutions and 11 countries or regions.

#### A. Analysis of the Cooperative Countries

Over the past eleven years, Jiangxi Normal University is still relatively destitute on international cooperation in ESI materials science, with a total of 70 times of cooperation. The most is the United States, 22 times, followed by Germany. From the CNCI citation index, the cooperation with Germany is more compelling, with 16 collaborative papers, 541 citations and an average of 33.81 citations. The CNCI is more than twice the global average, manifesting that the quality of the cooperative paper with Germany is so high that has secured a great academic influence.

#### B. Analysis of the Cooperative Institutions

There are 134 cooperative organizations of Jiagnxi Normal University in ESI materials science, among which China's local institutions account for 74.6%. Five key points can be summarized in the analysis of cooperative institutions. Firstly, closer cooperation exists between researchers of Jiangxi Normal University and domestic and foreign institutions, but the frequency of cooperation is relatively low. The most frequent cooperation in the past decade was with the Chinese Academy of Sciences, with 43 collaborative papers (see Fig 4 ). Secondly, according to the top ten cooperative institution in paper quantity in WOS, paper quality is relatively average, among which the frequency of the cited papers in five institutions is below the average. The cooperation with Yangtze Normal University rarely remains 0.75, which indicates that the quality of the papers is still needed to improve. Thirdly, the institutions with high frequency of cooperation and high quality of paper fall on Changchun Institute of Applied Chemistry and CAS, with all articles cited to 65.7, CNCI 3.61. Fourthly, among the institutions whose quantity of papers in cooperation reached the top ten, there are three non-native institutions, while among the institutions whose times cited has entered the top ten(see Fig 5), all are universities or research institutes in mainland China. It can be seen that the materials science in mainland China has played an influential role in the world. Fifthly, although the quality of cooperative papers is relatively high, the frequency is low. For instance, universities such as Fudan University, East China University of Technology and Sun Yat-sen University are all near Jiangxi Province and their quality of the collaborative papers is very high, with CNCI far exceeding the benchmark value of 1, but have only 4 times, 6 times, and so on in times cited.

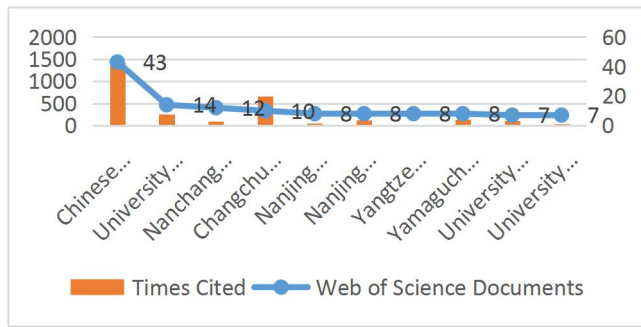


Fig. 4. Top Ten Cooperative Institutions by WOS Documents

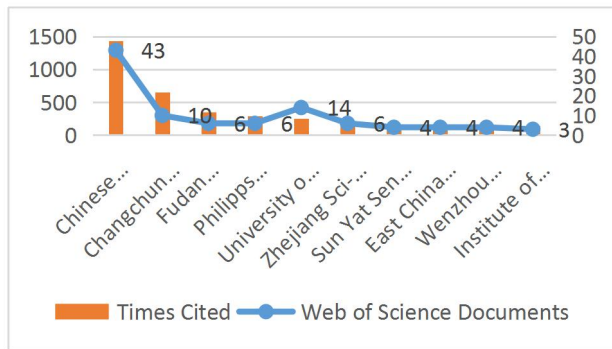


Fig. 5. Top Ten Cooperative Institutions by Times Cited

B. Analysis of the Core Author Contribution

Previous literature tend to regard the minimum number of authors' paper publications, usually determined by Price's law, as the criteria of core author candidates, but this thesis emphasizes that authors' paper publication and times cited should be taken into consideration for evaluating the core authors. Therefore, this research is based on the calculation formula:  $MP(WOS\ Documents) = 0.749 \sqrt{M_{P_{MAX}}}$  and  $Mc(times\ cited) = 0.749 \sqrt{M_{P_{MAX}}}$ , proposed by Price's Law, concluding that MP of all authors of materials science in Jiangxi Normal University is 5.55 and Mc is 30.51; MP of the first author is 3.26 and Mc is 12.95. It can be confirmed that there are 22 core authors in materials science of our school via investigating authors whose theses meet the above two criteria, and most of their citations have outstripped the standard value, indicating that their academic papers have relatively high influence.

V. COMPARISON BETWEEN JOURNAL PUBLICATION RECOMMENDATION AND DISCIPLINE THRESHOLD

A. Journal Publication Recommendation

The impact factors of journals in different disciplines cannot be compared horizontally, since in general, the average level of impact factors of biomedical journals is relatively higher than that of journals such as engineering. This research focuses on the papers in 2008- 2018 from the latter five normal university, Shanghai Normal University, Nanjing Normal University, Harbin Normal University, Henan Normal University and Northwest Normal University, in materials science and Jiangxi Normal University by statistics method, and summarized that there are 179 kinds of journals. This thesis is recommending 20 (see TABLE I) journals whose volume of paper publication is greater than or equal to 40, providing objective basis and reference for researchers of normal universities to publish articles. Among the 20 journals in the table, the articles published by researchers of Jiangxi Normal University are merely limited to seven journals, in which the quantity of paper is out of the average, and the number of papers published in one of the two journals is zero, demonstrating that the researchers of the institution are not interested in the material science journals.

IV. ANALYSIS OF THE ESI MATERIALS SCIENCE CONTRIBUTION

A. Analysis of the Secondary Unit Contribution

340 papers in materials science are downloaded from the core collection of Web of Science in this thesis, and the contribution of the paper output in Jiangxi Normal University's second-level college to ESI materials science is obtained via analyzing, from which the top three colleges with the highest contribution to materials science are College of Chemistry (190 articles, 55.9%), College of Physics (101 articles, 29.7%), Departmental research laboratories (23 articles, 6.8%) and College of Life Science (12 articles, 3.5%). These three second-level colleges have contributed a total of 307 papers, accounting for 95.9% of the ESI materials science papers in our school, which is the main force for the publication of materials science papers. And in the citation contribution are still the above four colleges whose sum of paper citations account for 98.76%.

TABLE I. JOURNAL PUBLICATION RECOMMENDATION IN ESI MATERIALS SCIENCE

Journal Publication	5-Year Impact factor	WOS Documents	Times Cited	Citation Impact	Jiangxi Normal University's WOS Documents	Jiangxi Normal University's Times Cited
APPLIED SURFACE SCIENCE	3.743	212	2919	13.77	21	170
JOURNAL OF ALLOYS AND COMPOUNDS	3.315	209	2625	12.56	26	305
MATERIALS LETTERS	2.466	196	1979	10.10	44	365
JOURNAL OF MATERIALS CHEMISTRY A	9.531	140	3799	27.14	20	574
JOURNAL OF POWER SOURCES	6.117	127	3424	26.96	26	759
ACS APPLIED MATERIALS & INTERFACES	8.284	121	3019	24.95	12	331
JOURNAL OF NANOSCIENCE AND NANOTECHNOLOGY	2.1	77	325	4.22	2	2
CERAMICS INTERNATIONAL	2.882	64	530	8.28	1	8

Cont. to TABLE I						
JOURNAL OF MATERIALS CHEMISTRY B	4.959	63	597	9.48	3	9
NANOTECHNOLOGY	4.017	59	986	16.71	16	287
MATERIALS CHEMISTRY AND PHYSICS	2.503	52	959	18.44	0	0
JOURNAL OF MATERIALS SCIENCE	2.733	49	416	8.49	12	169
JOURNAL OF MATERIALS CHEMISTRY	6.171	46	2338	50.83	5	361
MATERIALS SCIENCE & ENGINEERING C-MATERIALS FOR BIOLOGICAL APPLICATIONS	4.628	46	373	8.11	0	0
JOURNAL OF MATERIALS CHEMISTRY C	5.688	44	374	8.50	9	82
JOURNAL OF MATERIALS SCIENCE-MATERIALS IN ELECTRONICS	1.992	43	63	1.47	5	1
JOURNAL OF SOL-GEL SCIENCE AND TECHNOLOGY	1.841	41	288	7.02	1	7
JOURNAL OF NANOPARTICLE RESEARCH	3.574	40	286	7.15	8	42
MATERIALS RESEARCH BULLETIN	2.368	40	312	7.80	7	65
OPTICAL MATERIALS	2.339	40	230	5.75	3	51

### B. Comparison in the threshold of ESI Materials Science

In order to be close to the ESI data, attention has been paid in the following points in this research: the time is set to 2008-2018 in the Incites, the document is limited to article and review and the research institution is fixed at Jiangxi Normal University. It is concluded that 340 WOS papers have been spotted with 5382 times of citation and 6078 times in the threshold of ESI materials science. The times cited of our school is 88.5% of the threshold, and the number of WOS papers accounts for 76.7% of the bottom institution, from which we can see that there is still a gap between the materials science in Jiangxi Normal University and international first-class disciplines in the aspect of the overall quantity and quality of papers.

## VI. CONCLUSION AND SOLUTIONS

### A. Conclusion

In the past eleven years, especially during the 12th Five-Year Plan period, the quantity and quality of papers in materials science of Jiangxi Normal University have been steadily increasing, but there are still some problems, such as insufficient number of papers, lack of academic influence, lack of high-impact researchers and so on.

### B. Solutions

- great efforts should be put to carry out the tilt policy, giving priority support to materials science. To promote the development of every discipline, we must not engage in the distribution of “mess” type or egalitarianism but provide certain tilting policies and key supports for the major disciplines identified by our school, galvanizing them to advance at an unprecedented speed to enter into the forefront of the discipline.
- it is also of great importance to introduce and train leaders in materials science, to establish materials science research institutes, and to form an influential research team. According to the statistics, three high-cited theses in materials science stem from the College of Chemistry, whose major contributors are Professor Hou Haoqing, Professor Lu Zhanghui and so

on and they are high-impact researchers in the chemical science as well. Based on the problem that scientific papers originate intensively from a few researchers, to actively introduce relevant disciplines and laboratory leaders in materials science to form an influential material science research team is crucial.

- colleges with high contribution rates should shoulder their respective responsibilities and formulate relevant specific development goals and policies. Through policy orientation, we should energetically guide the researchers of all the above institutions to publish articles in the journals of material science, and meanwhile, the training and guidance for teachers and students in paper writing and paper submission to the journals of materials science must be enhanced.
- cross-institutional, cross-border and cross-regional academic exchanges and cooperation need to be strengthened. It is beneficial to utilize approaches such as academic exchanges, project evaluations, and part-time professors to expand contacts with domestic well-known experts and research institutions, thus generating more collaborative papers and enhancing the academic influence of ESI materials science results. A number of empirical studies have registered that papers from collaborative research are generally cited more than those independently completed.

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