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THIN FILMS RESEARCH IN INDIA: SCIENTOMETRIC EVALUATIONS OF RESEARCH STUDY OUTCOME

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ABSTRACT:
The study examines thin films research output from India during 2000 to 2015 on different parameters including the growth, document type-wise distribution of publications, productivity and impact of most productive institutions and authors, preferred sources of publications in which Indian thin films researchers publish their works, and contribution of major collaborative partner countries. Scopus database has been used to retrieve the data for 16 years (2000-2015). It was found that India contributes 5.26% to the global research output on thin films. The highest i.e. 98.22% contributions appear in journals and conference proceedings. The top 15 most productive institutions and top 10 productive authors contributed 49.67% and 11.79% share to India's publication output and 53.56% and 17.41% share to India's citation output during 2000 to 2015. The top 31 publication sources together contributed 44.55% share to total thin films research output of India.
Keywords: HPLC, PDA, stability indication method, drug.

1. INTRODUCTION:

A thin film is a layer of material ranging from fractions of a nanometer (monolayer) to 1 several micrometers in thickness . The main purpose of depositing thin film optical coatings on an optical surface is to so modify it to provide environmental protection and / or improve optical per formance. Thin fi lms have very interesting properties because of the fact that their properties depend on a number of interrelated parameters and also on the technique employed for their fabrication. It has great potential for scientific, industrial, consumer and military applications. R e s earc h e rs hav e s u c c e eded i n developing techniques for extremely well controlled (atomic layer by layer) growth of thin films, and are currently active in computer modelling for predicting physical and chemical properties of new thin films 2 materials . By taking into consideration the objectives, period

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and source database, it is seen that there are no specific studies available in the literature dealing with scientometric analysis of publications in the area of 'Thin films' research in India, though some of the relevant studies are conducted by Nagarkar, Prabakar, Bhattacharya & 3,4,5 Meye

OBJECTIVES :

To study the growth of world and Indian research output and research performance to find out document type distributions of publications. To identify the prolific Indian thin films researchers. To find preferred sources in which Indian thin films researchers publish their works. To examine thin films research collaboration.

2. RELATED STUDY:

Transparent conductors (TCs) are an important component of optoelectronic devices and nanoscale engineering of TCs is important to optimization of the device performance. Despite being a commonly used TC in photovoltaic devices, fluorine-doped tin oxide (FTO) has limited transmittance in solar spectrum. Improving the light transmittance and light scattering properties of FTO may lead to increased light absorption in the active volume of the photovoltaic device. In this work, patterned periodic arrays of nanopillars and nanolines of pitch size of ~700 nm were created on FTO using nanoimprint lithography and reactive ion etching using environmentally friendly gases. The patterned FTO photonic crystal exhibits enhanced light scattering as compared to the unpatterned FTO, which agrees well with simulations based on Finite Difference Time-Domain method. Dye sensitized solar cells fabricated on the patterned FTO exhibited improved performance (fill factor and efficiency), which can be attributed to enhanced incident photon to-current conversion in the range 400 - 650 nm as suggested also by theoretical simulations. The major focus of my research has been on the fabrication of carbon-based nanomaterials for the application of energy conversion and storage devices. Recently, we have prepared graphene on Cu substrate with various textures using chemical vapor deposition. Doped graphene nanohole arrays were fabricated for flexible transparent conductor, as shown in Figure. Also we have developed an oxide-assisted self-

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assembly method for the growth of triangular graphene grains on cubic texture Cu substrates and the investigation of growth mechanism of graphene, as shown in Figure. By engineering substrates, we can prepare graphene film with uniformity, high conductivity and transparency.

3. PROPOSED METHODOLOGY:

It should be realized that majority of thin films used for electronically and electrical devices need to be grown epitaxially, which normally requires a single crystal substrate with perfect lattice match and chemical compatibility. This has been a great limitation in practical applications. The IBAD texturing technique provides a novel approach for epitaxy of thin films on nontextured substrates. IBAD-MgO has been successfully used to build texture on long metallic tapes for large scale application of HTS YBCO coated conductors. High quality texture can be built within few minutes on about 10 nm IBAD-MgO deposition. Homo-epitaxial MgO layer and other buffer layers can be used to further improve the epitaxy and surface compatibility with YBCO.

IBAD-MgO on non-metallic flexible Ceraflex. AC loss has been a serious concern of YBCO coated conductor applications since most of HTS electrical devices need to work in a strong AC field. Non-metallic flexible Ceraflex is a possible candidate as substrate to reduce AC loss of YBCO coated conductors. It has very high resistivity so the eddy current loss will be totally removed; it also has excellent compatibility with YBCO since its composition is YSZ. It is flexible but the surface is very rough with Ra~100nm, which is not suitable for IBAD-MgO texturing. We used multi-layer Spin-on-Glass (SOG) coat the original surface and reduce the Ra to about 1nm. Textured IBAD-MgO template has been developed on the SOG smoothened Ceraflex; then highly textured SrTiO3 film has been grown on top. Preliminary YBCO growth experiment on IBAD-MgO textured Ceraflex shows the phase is pure and the Tc is about 88K, optimization is still in progress.

IBAD-MgO on glass. Amorphous buffer layers are normally necessary for IBAD-MgO texturing process. These buffer layers will induce additional loss and decrease the

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efficiency. We tried to use Ar+ pre-bombarding to activate the substrate surface and obtained highly textured IBAD-MgO template on unbuffered glass. By optimizing the pre-bombarding time, the best texture quality, in-plane ??~6.5o and out-of-plane FWHM~2o, has been obtained.

Ion beam assisted deposition (IBAD) is widely used on developing textured templates on amorphous substrates in last few years. It should be realized that majority of thin films used for electronical and electrical devices need to be grown epitaxially, which normally requires a single crystal substrate with perfect lattice match and chemical compatibility. This has been a great limitation in practical applications. The IBAD texturing technique provides a novel approach for epitaxy of thin films on nontextured substrates. IBAD-MgO has been successfully used to build texture on long metallic tapes for large scale application of HTS YBCO coated conductors. High quality texture can be built within few minutes on about 10 nm IBAD-MgO deposition. Homo-epitaxial MgO layer and other buffer layers can be used to further improve the epitaxy and surface compatibility with YBCO.

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Sr. No.	Collaborative Countries	TP	TC	ACCP	Share
1.	South Korea	808	14009	17.34	18.61
2.	United States	672	19439	28.93	15.48
3.	Germany	375	6423	17.13	8.64
4.	Japan	338	6957	20.58	7.79
5.	France	297	5272	17.75	6.84
6.	United Kingdom	215	4075	18.95	4.95
7.	Taiwan	195	2634	13.51	4.49
8.	Other Countries (N =76)	1441	16204	11.24	33.20
	Total	**4341**	**75013**	**18.18**	**100**

TP = Total Publications; TC = Total Citations; ACPP= Average Citation Per Paper

5. CONCLUSION:

The world has contributed 274419 papers in thin films research, which increased from 10620 to 19967 papers from the year 2000 to 2015. It is observed that the publications on thin films are rapidly growing in India. The highest i.e.1767 publications appeared in the year 2014. It is found that the highest Indian publications in thin films research appeared as journal articles and conference papers. The other types of publications viz. Book chapters, reviews, letters and editorials etc. accounted for 1.78% share in thin films research in India. The top most 15 productive institutions on thin films research accounted for 49.67% publication share and 53.56% citation share. First 3 top productive institutions i.e. Indian Institute of Science, Bangalore, Shivaji University, Kolhapur and Indian Institute of Technology, Delhi contributed highest publications share than the group average. The top 10 most productive Indian authors in research on thin films accounted for 11.79% publication share and 17.41% citation share. The average h-index value of these authors is 30.4. The apex 31 sources preferred by the Indian thin films researchers were identified. These sources together contributed 44.56% share of total thin films research output of India during 2000 to 2015. AIP conference proceedings contributed highest publications i.e.10.17%. The top seven collaborative countries contributed 66.80% publications share in Indian thin films research output.

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