

表面波プラズマにより表面処理された 酸化亜鉛薄膜の構造的、光学的特性に関する研究

Investigation on the Structural and Optical Properties of Zinc Oxide Thin Films Modified by Surface Wave Plasma

H27海自39

派遣先 第32回電離気体現象に関する国際会議（ルーマニア・ヤシ）

期 間 平成27年7月26日～平成27年7月31日（5日間）

申請者 国立法人 静岡大学創造科学技術大学院

学術研究員 Ciolan Mihai Alexandru

海外における研究活動状況

研究目的

マグネトロンスパッタリングにより作製した酸化亜鉛薄膜を用い、アルゴンガスにアンモニアを添加したプラズマ処理を施すことによって、結晶構造の変化及び光学特性にどのような変化を及ぼすかを明らかにし、最終的にはプラズマ表面処理による酸化亜鉛薄膜の特性向上を目指すことを目的としている。

海外における研究活動報告

Research Objectives

Structural and optical properties of zinc oxide based thin films are of great interest for the development of novel biosensing devices. Plasma technologies have already proven to be suitable, simple and efficient ways to change and, in some cases, to even enhance some specific properties of materials.

Among semiconductor based materials zinc oxide is one of the most studied and already implemented in a wide range of commercial applications. The possibility to create new reac-

tive sites on the surface of the materials is of great interest offering the possibility to further connect biomolecules that will serve as platform for novel biosensing chips development.

In my study microwave excited surface plasma is employed to change the surface of zinc oxide thin films grown on quartz substrate by magnetron sputtering. X-Ray Diffraction and photoluminescence measurements are used to investigate the crystalline structure and the optical properties of zinc oxide to better understand and highlight the modification induced by plasma processing.

1. Conference overview

This prestigious conference has been the forum for discussion since 1953 of nearly all fields in plasma science, from the fundamentals of the interaction of charged particles with molecules to plasma chemistry, surface treatment and thin film technology, plasma medicine, light sources, plasma assisted combustion, plasma material processing, atmospheric and stellar plasmas, environmental protection and pollution control,

plasma aerodynamics, and non-thermal plasmas in fusion devices. It is a natural continuation of the last three ICPIG editions held in Cancun (Mexico, 2009), Belfast (UK, 2011) and Granada (Spain, 2013).

The conference offered a complete scientific programme consisting of 10 general and 24 topical invited lectures covering nearly all topics in the field of ionized gases, given by worldwide leaders in their fields and two special sessions on hot topics in plasma physics.

The scientific programme also included lectures from the winners of the von Engel & Franklin Prize and the IUPAP Young Scientist Medal and Prize in Plasma Physics.

Moreover, a socio-cultural programme provided opportunities for discovering of an old but also modern town which candidates for European Capital of Culture for 2021.

2. Activities overseas

I participated at the International Conference on Phenomena in Ionized Gases ICPIG 2015 held from July 26st to 31st July, 2015 where I gave a poster presentation of my work on the “Investigation on the structural and optical properties of zinc oxide thin films modified by surface wave plasma”.

I attended the presentations given by the invited speakers regarding plasma technologies and their applications in various novel fields. Due to the large number of participants from all over the world I had the chance to understand more about the actual research performed nowadays and possible implications to industry and for developing new applications in diverse fields like medicine, optoelectronics and so on.

The presentations that I found most interesting were the ones regarding plasma assisted processing of nanomaterials and nanostructures for development of new bioapplications. There were several presenters and I need to mention here M. Keidar (USA), I. Topala (Romania), S. Reuter (Germany), L. Sirghi (Romania), M. Nagatsu (Japan) which gave interesting and useful presentations about the current trends for developing new bioapplications with direct implication for medical industry.

I also attended the poster presentations, 248 in total, where I had the chance to discuss in detail about the original work of different research groups, which will have a great impact for developing new application by employing plasma technologies.

During this conference I had the chance to reunite with many good friends from all over the world and discuss about their very interesting research.

3. Summary of my presentation

On July 28th I presented our work in the third poster session. I discussed very interesting results regarding the functionalization of zinc oxide thin films deposited by radio frequency (RF) magnetron sputtering. While zinc oxide is a well study material in the last decades, the functionalization of its surface with functional groups by plasma processing is a novel approach offered as an alternative to complicated wet chemical procedures. For the first time we promote the use of low temperature plasma as a functionalization method for zinc oxide trying to overcome some of the issues of the wet chemical methods.

Plasma-surface modification is an effective

and economical surface treatment technique for many materials and of growing interests in biomedical engineering. The unique advantage of plasma processing is that the surface properties and biocompatibility can be selectively enhanced, thus enhancing the performance of the nanomaterials.

I presented my latest results regarding the modification induced in the crystallographic structure of the materials and the enhancement of the optical properties after plasma processing. I have clearly shown that the crystallographic structure of the zinc oxide can be improved with plasma processing and also, optical properties of the material can be tuned. The feedback that

I received from other participants it was very useful and I will take it into consideration for my future work.

Attending this conference has been a great opportunity for me and I had the chance to meet and discuss with various groups all over the world.

I am very grateful for receiving this travel aid from Murata Science Foundation.

この派遣の研究成果等を発表した
著書、論文、報告書の書名・講演題目

[ポスター発表題目]

Investigation on the structural and optical properties of zinc oxide thin films modified by surface wave plasma
(表面波プラズマにより表面処理された酸化亜鉛薄膜の構造的, 光学的特性に関する研究)