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Short Communication

# Bioenergy 2019- Nitrogen ion implantation effect on the physical properties of copper oxide thin films on glass substrate

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One of the method for engineering the structural properties of a metal oxide to modify its optical and electrical properties, is nitrogen doping. In this context nitrogen doping in copper oxide is a paramount research topic because of its potential for surmounting the disadvantage of copper oxide its high resistance. In this paper effect of nitrogen ion implantation on copper oxide thin film deposited on glass substrate by DC magnetron sputtering has been studied. In order to investigate the effect of the nitrogen ion implantation on copper oxide thin film, the crystallographic structure of the samples was obtained utilizing X-ray diffraction method. Atomic force microscopy and scanning electron microscopy were utilized for surface morphology investigation and UV-VIS spectrophotometer was utilized for optical properties. The XRD patterns showed Cu2O:N formation with an orthorhombic structure in implanted sample. The SEM images showed some paramount vicissitude in the surface morphology after nitrogen ion implantation in such a way that some interconnected apertures engendered on the surface. According to the AFM images, the roughness of the samples after implantation is decremented and transmuted due to the ballistic effect of the ions implanted. The study on optical properties showed that nitrogen ion implantation promoted the delocalization of charge carriers as a result, the optical band gap decremented. Another result of nitrogen ion implantation was minimizing resistivity of samples which the I-V characteristics was performed with keithley-2361system. The results provide a subsidiary experimental instance of N doped copper oxide synthesis and would promote the research and applications of Cu2O:N contrivances such as photovoltaic material systems.

Keywords: Nitrogen ion implantation, copper oxide thin films, XRD, SEM, AFM

## Introduction:

The development of incipient materials is driven by the high impact of such materials in paramount areas such as information technology, energy management, environmental aegis, and human health. Most of these applications require contrivances having surface layers and thin film coatings or felicitously doped matrices with dedicated properties and structure. For many applications such accurately configured structures cannot be achieved by thermal diffusion methods. Ion beam methods, on the other hand, offer precise control of implanted ion/dopant species, and implantation fluence, profile and temperature. They can be acclimated to grow nanocomposite materials by ion beam deposition, to engender nano-patterned surfaces of materials by ion beam erosion, to introduce impurities into matrices by ion implantation, or to investigate novel properties resulting from impurity–defect interactions. Ion beam modification of materials may be achieved by ion implantation or ion irradiation. These are unique approaches to altering the near surface region of a wide range of solid materials in a manner that is independent of many of the constraints associated with conventional processing methods. Some materials, such as metals and most semiconductors, are rather callous to the electronic part of the energy deposition as long as the electronic ceasing power remains below a certain critical threshold value. Other materials, for example insulating and dielectric materials such as ionic solids, alkali and silver halides, dielectric glasses and amorphous materials, are quite sensitive to the energy deposited in their electronic systems. The high sensitivity of these materials to ion irradiation makes them concretely alluring for ion beam modification. A comprehensive programme on ion beam modification requires not only facilities for materials engenderment and ion beam implantation/irradiation, but withal modern methods of analysis and diagnostics in order to characterize the ion beam induced effects. All these facilities may not be available in one laboratory, but can be achieved by betokens of collaboration between laboratories and scientists from developed and developing Member States. In the latter case, in particular, with opportune partnerships with research centres in developed Member States and participation in research networks, research students and scientists have access to world class facilities and are able to capitalize on facility manpower supervision to enhance research development. These issues and concerns impacted upon the research activities in this CRP which were organized into five main areas, namely:

(1) Study of crystalline materials (e.g. silicon carbide and diamond) using ion beams;

(2) Development of methods and techniques for ion implantation to produce buried layers; (3) Synthesis of sub-micron sized elemental phases and compounds with novel properties;

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(4) Ion induced modification of polymer properties;

(5) Ion beam modifications of metal-nitride layers. Eight projects were selected within this CRP, whose achievements are summarized in the following sections.

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## Conclusion:

Silicon ion implantation in polymers results in modification of sundry properties of the polymer material. Relatively low doses yield intriguing photoluminescence properties modification, like emergence of UV range PL in UHMWPE, and appearance of photoluminescence enhancement (PLE) effect in PMMA. These effects could be cognate to the emergence of incipient PL sites resulting from the presence of Si and/or SiC predicated clustering in the implanted polymer surface. Evidence for such clustering is supplied by the results of IR and Raman spectroscopy, as well as by SEM studies of the implanted materials and Si elemental analysis. In order to define the form and size of the clusters, adscititious TEM experiments are in run. High doses silicon implants are categorically efficacious for the engenderment of such Si and SiC cluster networks, as suggested by IR and Raman spectroscopy, as well as by micro-hardness quantifications. Possible increase of this efficacy for the lower doses, which would increment additionally the cost efficacy of the method, could be sought by different post-implantation processing of the implanted polymer materials, especially by low temperature methods like  ray irradiation, which was not available in our institution during the time of the present research.

Note: This work is partly presented at 5th World Bioenergy Congress during April 15-16, 2019 held at Tokyo, Japan