

# **Pulsed Laser Deposition Of Thin Films**

Ion N. Mihailescu, Anna Paola Caricato

#### **Pulsed Laser Deposition Of Thin Films:**

Pulsed Laser Deposition of Thin Films Robert Eason, 2007-12-14 Edited by major contributors to the field this text summarizes current or newly emerging pulsed laser deposition application areas It spans the field of optical devices electronic materials sensors and actuators biomaterials and organic polymers Every scientist technologist and development engineer who has a need to grow and pattern to apply and use thin film materials will regard this book as a must have resource Pulsed Laser Deposition of Thin Films Douglas B. Chrisey, Graham K. Hubler, 1994-06-21 A comprehensive overview of what is required to set up and begin research in this newly developing technology and understand the basics of the process Internationally recognized experts in their fields cover such fundamentals as history theory film characteristics surface modification laser technology materials and applications including excellent reviews regarding the entire areas of semiconductor buffer layers thin film ferroelectrics and ferrites along with the work involving films deposited by PLD

Pulsed Laser Deposition Of Thin Films D.B. Chrisey, Pulsed Laser Deposition of InP Thin Films Theodore T. Fabrication of Thin Films by Pulsed Laser Deposition for Clean Energy Applications Xiaojun Zhang, 2011 Pekny, 1990 Pulsed laser deposition PLD is a physical vapor deposition technique for thin film fabrication Compared with other techniques pulsed laser deposition technique has advantages such as stoichiometry flexibility versatility lower deposition temperature ability to grow metastable materials Because of these advantages pulsed laser deposition has been widely used in materials research In this dissertation pulsed laser deposition has been used to grow thin films for solid oxide fuel cell light emitting diode and solar cell applications Firstly yttria stabilized zirconia YSZ and cerium dioxide CeO2 thin films are deposited in oxygen deficient environments their properties are compared to those deposited in oxygen rich environments Oxygen deficient films are highly 001 oriented which corresponds to a surface that is expected to be forbidden based on Tasker's theoretical calculation of stoichiometric ionic crystals A model considering non stoichiometry induced surface relaxation and surface atomic density is proposed to explain the orientation phenomenon observed under oxygen deficient deposition conditions This model is consistent with previous experimental results for indium tin oxide ITO SnO2 and NiO thin films deposited under similar conditions Detailed studies of the preferred orientation of these oxygen deficient ionic crystals are of direct relevance to the fabrication of films for use in solid oxide fuel cells Secondly undoped Cu doped Se enriched Cu2Se doped Ag doped Ag2Se doped and nitrogen doped ZnSe films have been grown on fused guartz substrates by pulsed laser deposition It is found that adding a small amount 2 mol% of Cu2Se can significantly improve crystallinity and 111 texturing of ZnSe films While the other films are highly resistive Cu2Se doped ZnSe films are p type conducting with hole concentrations of cm 3 and resistivity of 0 098 ohm cm compared with previous reports of cm 3 and 0 75 ohm cm respectively The successful heavy p type doping of ZnSe films is attributed to substitution of Zn atoms with Cu while limiting selenium vacancy associated compensating defects with additional selenium Nitrogen doping has turned ZnSe films more favorable to

wurtzite structures Two newly observed Raman peaks at 555 cm 1 and 602 cm 1 are assigned to N local vibrational modes of hexagonal ZnSe structures The nitrogen doped ZnSe films are not conductive which might be due to compensating defects arising from the presence of native defects or other impurities. This work is of importance to solve doping difficulties and contact problems of wide bandgap semiconductors Finally batch growth of thin films by pulsed laser deposition has been tried Using the natural temperature gradient films with different deposition temperatures have been fabricated together With change of deposition temperatures ZnSe films are shown to have problems associated with crystalline defects selenium loss or phase separation ZnSe films with improved crystallinity and no phase separation have been achieved using a 16 mol% Se enriched target Multi plume pulsed laser deposition has been proposed and discussed With directionality of PLD plumes and non uniformity of PLD films this system is supposed to be more suitable for high throughput compound thin film fabrication which makes it very promising for efficient materials optimization and exploration High throughput fabrication of compound thin films has been successfully achieved using this system Pulsed Laser Ablation Ion N. Mihailescu, Anna Paola Caricato, 2018-01-09 Pulsed laser based techniques for depositing and processing materials are an important area of modern experimental and theoretical scientific research and development with promising challenging opportunities in the fields of nanofabrication and nanostructuring Understanding the interplay between deposition processing conditions laser parameters as well as material properties and dimensionality is demanding for improved fundamental knowledge and novel applications This book introduces and discusses the basic principles of pulsed laser matter interaction with a focus on its peculiarities and perspectives compared to other conventional techniques and state of the art applications. The book starts with an overview of the growth topics followed by a discussion of laser matter interaction depending on laser pulse duration background conditions materials and combination of materials and structures The information outlines the foundation to introduce examples of laser nanostructuring processing of materials pointing out the importance of pulsed laser based technologies in modern nano science With respect to similar texts and monographs the book offers a comprehensive review including bottom up and top down laser induced processes for nanoparticles and nanomicrostructure generation Theoretical models are discussed by correlation with advanced experimental protocols in order to account for the fundamentals and underline physical mechanisms of laser matter interaction Reputed internationally recognized experts in the field have contributed to this book In particular this book is suitable for a reader graduate students as well as postgraduates and more generally researchers new to the subject of pulsed laser ablation in order to gain physical insight into and advanced knowledge of mechanisms and processes involved in any deposition processing experiment based on pulsed laser matter interaction Since knowledge in the field is given step by step comprehensively this book serves as a valid introduction to the field as well as a foundation for further specific readings Short-pulsed Laser Deposition of Thin Films of YBaCuO Vikram Shanmugasundaram, 2000 This thesis investigates deposition of superconducting thin films of YBaCuO using short pulsed

laser deposition technique The effects of temporal pulse width and target density on the deposition of thin films of YBaCuO were studied Experiments were conducted with pulse widths of 27 ns 16 ns and 150 fs and target densities of 80% and 90% Scanning electron microscope photomicrographs and profilometer traces show a striking difference between nanosecond and femtosecond laser irradiation Shortening the pulse width reduced particulate formation provided stoichiometry and improved the film properties Decreasing the target density produced thicker but nonuniform films and reduced particulate formation A thermal model was applied to predict the temperature distributions inside the target and thereby identify the effects of short pulses on the collateral thermal damage. The surface ablated by the ns laser were highly disrupted underwent melting and resolidification contained micron sized pores and exhibited large heat affected zones In contrast the surface ablated by the fs laser were smooth and free from recast layer underwent direct evaporation and consisted of cone like structures <u>Laser Deposition of Oxide Thin Films and Their Properties</u> Donghwan Kim, 1995 Pulsed Laser Deposition of Thin Film Material for Nonlinear Waveguides, 1994 Pulsed Laser Deposition PLO was used in order to fabricate thin films of various classes or materials of interest for future nonlinear optical waveguide devices Materials investigated included potassium niobate potassium tantalate niobate KTN and aluminum nitride SiU films were also grown and studied as a step in producing doped glass films via PLD The films were characterized with several techniques including Rutherford backscattering spectroscopy x ray diffraction optical microscopy electron microscopy and when feasible ellipsometry and UV visible light transmission In addition a method was devised to enhance the thickness uniformity or PLU fabricated thin films which is notoriously poor This method uses a comic optic or novel design in order to produce concentric annular sources at the target being ablated In principle uniform coverage within rew percent is achievable for substrate sizes or a few inches using current technology MM Nd-Fe-B Thin Films Deposited by Pulsed Laser Deposition Xiaojuan Huang, 2001

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