



Pulsed Laser Deposition Of Thin Films

Liviu Duta, Andrei C. Popescu



Pulsed Laser Deposition Of Thin Films:

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 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 D.B. Chrisey, *Pulsed Laser Deposition of InP Thin Films* Theodore T. Pekny, 1990

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

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

Fabrication of Thin Films by Pulsed Laser Deposition for Clean Energy Applications Xiaojun Zhang, 2011 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 CeO_2 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 SnO_2 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 Cu_2Se doped Ag doped Ag_2Se doped and nitrogen doped ZnSe films have been grown on fused quartz substrates by pulsed laser deposition It is found that adding a small amount 2 mol% of Cu_2Se can significantly improve crystallinity and 111 texturing of ZnSe films While the other films are highly resistive Cu_2Se 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. **Current Research in Pulsed Laser Deposition** Liviu Duta, Andrei C. Popescu, 2021-08-30

Despite its limitation in terms of surface covered area, the PLD technique still gathers interest among researchers by offering endless possibilities for tuning thin film composition and enhancing their properties of interest due to i) the easiness of a stoichiometric transfer even for very complex target materials ii) high adherence of the deposited structures to the substrate iii) controlled degree of phase crystallinity and thickness of deposited coatings iv) versatility of the experimental set up which allows for simultaneous ablation of multiple targets resulting in combinatorial maps or consecutive ablation of multiple targets producing multi-layered structures and v) adjustment of the number of laser pulses resulting in either a spread of nanoparticles, islands of materials, or a complete covering of a surface. Moreover, a variation of PLD known as Matrix-Assisted Pulsed Laser Evaporation allows for deposition of organic materials ranging from polymers to proteins and even living cells, otherwise difficult to transfer unaltered in the form of thin films by other techniques. Furthermore, the use of laser light as transfer agent ensures purity of films and pulse-to-pulse deposition allows for an unprecedented control of film thickness at the nm level. This Special Issue is a collection of state-of-the-art research papers and reviews in which the topics of interest are devoted to thin film synthesis by PLD and MAPLE for numerous research and industry field applications such as bio-active coatings for medical implants and hard protective coatings for cutting and drilling tools withstanding high friction and elevated temperatures, sensors, solar cells, lithography, magnetic devices, energy storage and conversion devices, controlled drug delivery, and in situ microstructuring for boosting of surface properties. **Pulsed Laser Deposition of Oxide Thin**

Films and Their Properties Donghwan Kim, 1995 **Pulsed Laser Deposition of Thin Films** Robert Eason, 2007 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 Film Material for Nonlinear Waveguides*, 1994

Pulsed Laser Deposition (PLD) 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 (AlN). 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 of PLD fabricated thin films, which is notoriously poor. This method uses a conic optic or novel design in order to produce concentric annular sources at the target being ablated. In principle, uniform coverage within a few percent is achievable for substrate sizes of a few inches using current technology.

Deposition of Polypyrrole Thin Films by Advanced Method Dušan Kopecký, Martin Vrnata, Premysl Fitl, Filip Vysloulil, 2011. The development of new types of electronic devices based on conductive polymers requires precise and controlled deposition of these materials in thin layers. This book examines the latest results in research of deposition of polypyrrole (PPY) thin films by advanced method Matrix Assisted Pulsed Laser Evaporation (MAPLE). It also provides a brief survey of the laser deposition of conductive polymers, theoretical analysis of the mechanisms of deposition by MAPLE method, definition of both source PPY properties and deposition conditions necessary for successful thin layer fabrication.

Nd-Fe-B Thin Films Deposited by Pulsed Laser Deposition Xiaojuan Huang, 2001. **Physical Deposition Methods for Films and Coatings** Lech Pawlowski, 2025-01-14. Comprehensive resource on the subject of deposition techniques for films and coatings and their characterization. *Physical Deposition Methods for Films and Coatings* presents a pedagogical compilation of current knowledge of dry deposition. Written by a renowned and awarded academic with more than 40 years of experience in the field, *Physical Deposition Methods for Films and Coatings* covers topics including: The process of making a deposit that appears on the surface; growth of deposits; their post-treatments and characterization methods; Different physical and chemical deposition techniques including atomistic, chemical vapor, and various thermal spraying methods; Properties of deposits depending on the material and deposition technique; Substrate preparation; coating microstructure and morphology; and stability of thin films. Examples of applications of thin films in optical devices, environmental applications, telecommunications devices, and energy storage devices. *Physical Deposition Methods for Films and Coatings* is an essential reference on the subject for professionals and researchers in surface treatment and graduate students in related programs of study.

Pulsed Laser Deposition of Thin-film Oxides for Waveguide Lasers Jake Jonathan Prentice, 2020. **Development of a Pulsed-laser Technique for Thin Film Deposition** David J. Uhl, 2019. The majority of nanotechnology related research at the CSCU CNT at Southern Connecticut State University involves depositing thin films of controlled thicknesses using a thermal physical vapor deposition method. The thermal evaporative method, however, is limited to the deposition of single transition metals with low melting points. This project greatly expands the scope of available materials for deposition through the development and implementation of a

pulsed laser deposition technique A solid state Nd YAG Q switched laser from 1989 was restored and aligned and a 3 dimensional CAD model of the high vacuum chamber was produced to aid in the configuration of the system The power output of the laser beam was monitored using a digital intensity readout the beam reached a maximum power of 2 Watts Three target elements were selected for deposition onto a Silicon substrate in order to test the efficiency of the system Copper Iron and Tantalum samples were exposed to the beam under vacuum for 5 minutes The Silicon substrates were imaged under a scanning electron microscope The images demonstrate successful depositions This development has greatly widened the scope of materials available for thin film deposition subsequently impacting future research at the CSCU CNT in the field of nanotechnology

Current Research in Pulsed Laser Deposition Liviu Duta, Andrei C. Popescu, 2021 Despite its limitation in terms of surface covered area the PLD technique still gathers interest among researchers by offering endless possibilities for tuning thin film composition and enhancing their properties of interest due to i the easiness of a stoichiometric transfer even for very complex target materials ii high adherence of the deposited structures to the substrate iii controlled degree of phase crystallinity and thickness of deposited coatings iv versatility of the experimental set up which allows for simultaneous ablation of multiple targets resulting in combinatorial maps or consecutive ablation of multiple targets producing multi layered structures and v adjustment of the number of laser pulses resulting in either a spread of nanoparticles islands of materials or a complete covering of a surface Moreover a variation of PLD known as Matrix Assisted Pulsed Laser Evaporation allows for deposition of organic materials ranging from polymers to proteins and even living cells otherwise difficult to transfer unaltered in the form of thin films by other techniques Furthermore the use of laser light as transfer agent ensures purity of films and pulse to pulse deposition allows for an unprecedented control of film thickness at the nm level This Special Issue is a collection of state of the art research papers and reviews in which the topics of interest are devoted to thin film synthesis by PLD and MAPLE for numerous research and industry field applications such as bio active coatings for medical implants and hard protective coatings for cutting and drilling tools withstanding high friction and elevated temperatures sensors solar cells lithography magnetic devices energy storage and conversion devices controlled drug delivery and in situ microstructuring for boosting of surface properties

The Pulsed Laser Deposition of High Temperature Superconducting Thin Films Kenneth Scott, 1992

Applications of Laser Ablation Dongfang Yang, 2016-12-21

Laser ablation refers to the phenomenon in which a low wavelength and short pulse ns fs duration of laser beam irradiates the surface of a target to induce instant local vaporization of the target material generating a plasma plume consisting of photons electrons ions atoms molecules clusters and liquid or solid particles This book covers various aspects of using laser ablation phenomenon for material processing including laser ablation applied for the deposition of thin films for the synthesis of nanomaterials and for the chemical compositional analysis and surface modification of materials Through the 18 chapters written by experts from international scientific community the reader will have access to the most recent research and

development findings on laser ablation through original research studies and literature reviews
Deposition and Optical Properties of SBN and SBT Thin Films Chunming Jin, 1998

Pulsed Laser

Reviewing **Pulsed Laser Deposition Of Thin Films**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Pulsed Laser Deposition Of Thin Films**," an enthralling opus penned by a very acclaimed wordsmith, readers set about an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve into the book's central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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