Low Energy Ion Assisted Film Growth

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Foreword

This book deals with the use of accelerated ion beams to assist the growth of thin films. It was recognised as early as the seventies that the bombardment of a growing film with a beam of accelerated ions induces significant changes in its properties and that these changes have many potential applications. The term “Ion beam assisted deposition” (IBAD) and the more general one “Ion assisted deposition” (IAD) were coined to characterise all the procedures of preparation of thin films that, in one way or another, use this type of approach. Since then, the modalities of this technology and its applications, in very different scientific and industrial areas, have expanded to constitute what is now a mature technique, useful for a tailored synthesis of thin films.

Within a general perspective, several books and reviews have dealt with the phenomena involved during the IAD of thin films. Itoh’s book of 1989 and some review papers by Smidt (1990), Hirvonen (1991) and Ensinger (1994, 1995, 1997) are noted examples of such publications. This literature covers the advances made during the seventies and eighties in the development of IAD techniques. Much research effort has contributed to new developments and to a more thorough understanding of the basic phenomena involved during IAD of thin films, not only providing an empirical perspective on the effects of ion bombardment on thin film properties, but permitting a clear interpretation of these phenomena on an atomistic scale. The present book aims to provide a comprehensive description of the basic phenomena involved in IAD processes, the different techniques of preparation of thin films that can be considered as ion assisted methods, and some of the applications of the prepared thin films in different fields of science and technology. Throughout this presentation, emphasis is put on results which appeared in scientific literature during the last decade, given that the most important contributions made before are properly discussed in these previous publications.

This book is written with the intention that it serve as an introductory manual for researchers, post-graduates and engineers from industry with little or no experience in IAD thin films. Nonetheless, some basic principles of the interaction

of ions with solid targets are also reviewed with the intention of providing a good scientific basis that will permit a sound and justified presentation of results and phenomena. In this respect, it is hoped that the book will also serve to provide researchers active in this scientific area with a general scheme and practical ideas for the improvement of their investigation in this interesting field of material science and technology.

The book is divided into five chapters dealing with, respectively, the basic principles of the interaction of accelerated ions with matter; a description of the different techniques relying on the IAD concept; the changes experienced by the thin films when subjected to ion bombardment; some applications of the IAD thin films in different fields of science and technology and a description of the major issues related with two sets of materials for whose synthesis the use of IAD procedures is essential (i.e., c-BN and diamond and related materials). Whenever possible, results by updated methods of characterisation of thin films are included as examples of the possibilities of the IAD procedures. In some cases, this presentation of experimental results is accompanied by a brief presentation of the technique, so that non-experts will also be able to understand the main message of the proposed case.

We hope that the reader will find this manuscript interesting and, what would be even more satisfactory for the authors, useful for their own investigations.

Finally, we would like to thank José A. Rodriguez for his good job preparing the drawings of the different deposition methods included in Chapter 2, and the support provided by the author's research institutions (i.e., CSIC, Universidad de Sevilla and Universidad Autónoma de Madrid).

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