# ELASTIC AND INELASTIC SCATTERING IN ELECTRON DIFFRACTION AND IMAGING



Zhong Lin Wang

P. Schattschneider

Elastic and Inelastic Scattering in Electron Diffraction and Imaging Zhong-lin Wang, 2013-06-29 Elastic and inelastic scattering in transmission electron microscopy TEM are important research subjects For a long time I have wished to systematically summarize various dynamic theories associated with quantitative electron micros copy and their applications in simulations of electron diffraction patterns and images This wish now becomes reality The aim of this book is to explore the physics in electron diffraction and imaging and related applications for materials characterizations Particular emphasis is placed on diffraction and imaging of inelastically scattered electrons which I believe have not been discussed exten sively in existing books This book assumes that readers have some preknowledge of electron microscopy electron diffraction and quantum mechanics I anticipate that this book will be a guide to approaching phenomena observed in electron microscopy from the prospects of diffraction physics The SI units are employed throughout the book except for angstrom A which is used occasionally for convenience To reduce the number of symbols used the Fourier transform of a real space function P r for example is denoted by the same symbol P u in reciprocal space except that r is replaced by u Upper and lower limits of an integral in the book are co co unless otherwise specified The co co integral limits are usually omitted in a mathematical expression for simplification I very much appreciate opportunity of working with Drs J M Cowley and J C H Spence Arizona State University I **Surface Microscopy with Low Energy Electrons** Ernst Bauer, 2014-07-10 This book written by a pioneer in surface physics and thin film research and the inventor of Low Energy Electron Microscopy LEEM Spin Polarized Low Energy Electron Microscopy SPLEEM and Spectroscopic Photo Emission and Low Energy Electron Microscopy SPELEEM covers these and other techniques for the imaging of surfaces with low energy slow electrons These techniques also include Photoemission Electron Microscopy PEEM X ray Photoemission Electron Microscopy XPEEM and their combination with microdiffraction and microspectroscopy all of which use cathode lenses and slow electrons Of particular interest are the fundamentals and applications of LEEM PEEM and XPEEM because of their widespread use Numerous illustrations illuminate the fundamental aspects of the electron optics the experimental setup and particularly the application results with these instruments Surface Microscopy with Low Energy Electrons will give the reader a unified picture of the imaging diffraction and spectroscopy methods that are possible using low energy electron microscopes Metals Abstracts, 1996 American Book Publishing Record, 1995 Japanese Journal of Applied Physics ,2002 HAP The British National Bibliography Arthur James Wells, 1995 Physics Briefs ,1994 ,1992 Surface and Interface Characterization by Electron Optical Methods Ugo Valdre, 2013-03-09 The importance of real space imaging and spatially resolved spectroscopy in many of the most significant problems of surface and interface behaviour is almost self evident To join the expertise of the tradi tional surface scientist with that of the electron microscopist has however been a slow and difficult process In the past few years remarkable progress has been achieved including the development of new techniques

of scanning transmission and reflection imaging as well as low energy microscopy all carried out in greatly improved vacuum conditions Most astonishing of all has been the advent of the scanning tunneling electron microscope providing atomic resolution in a manner readily compatible with most surface science diagnostic procedures. The problem of beam damage though often serious is increasingly well understood so that we can assess the reliability and usefulness of the results which can now be obtained in catalysis studies and a wide range of surface science applications. These new developments and many others in more established surface techniques are all described in this book based on lectures given at a NATO Advanced Study Institute held in Erice Sicily at Easter 1987 It is regretted that a few lectures on low energy electron diffraction and channeling effects could not be included Fifteen lecturers from seven different Countries and 67 students from 23 Countries and a wide variety of backgrounds attended the school **Electron Scattering And Related Spectroscopies** Maurizio De Crescenzi, M N Piancastelli, 1996-11-26 The main purpose of this book is to provide an overview of all phenomena which can be categorized under the general label of electron scattering and to give a comprehensive description of all spectroscopical techniques related to electron scattering phenomena Various classes of events are examined electron in electron out photon in electron out electron in two electron out electron diffraction together with the corresponding experimental techniques A description of the underlying physics of various electron scattering phenomena is provided For each spectroscopy the general principles the main fields of application and some selected representative cases are discussed The use of relatively low cost electron sources is emphasized with respect to photon sources The book is directed to PhD students and researchers not necessarily yet expert in the field Inelastic Scattering in Low-energy Electron Diffraction from Silver Willes H. Weber, 1968 Fundamentals of Inelastic Electron Scattering P. Schattschneider, 2012-12-06 Electron energy loss spectroscopy ELS is a vast subject with a long and honorable history. The problem of stopping power for high energy particles interested the earliest pioneers of quantum mechanics such as Bohr and Bethe who laid the theoretical foun dations of the subject The experimental origins might perhaps be traced to the original Franck Hertz experiment The modern field includes topics as diverse as low energy reflection electron energy loss studies of surface vibrational modes the spectroscopy of gases and the modern theory of plasmon excitation in crystals For the study of ELS in electron microscopy several historically distinct areas of physics are relevant including the theory of the Debye Waller factor for virtual inelastic scattering the use of complex optical potentials lattice dynamics for crystalline specimens and the theory of atomic ionisation for isolated atoms However the field of electron energy loss spectroscopy contains few useful texts which can be recommended for students With the recent appearance of Raether's and Egerton's hooks see text for references we have for the first time both a comprehensive review text due to Raether and a lucid introductory text which emphasizes experimental aspects due to Egerton Raether's text tends to emphasize the recent work on surface plasmons while the strength of Egerton's book is its treatment of inner shell excitations for microanalysis based on the use of atomic wavefunctions for crystal electrons

<u>Inelastic Low-Energy Electron Diffraction</u> J. O. Porteus, W. N. Faith, NAVAL WEAPONS CENTER CHINA LAKE CA., 1971 Combined inelastic scattering and diffraction inelastic diffraction provide a means of observing low energy electrons which have produced electronic excitation in bulk single crystals. The work shows the feasibility of extracting dispersion data from inelastic diffraction measurements Dispersion data in the 11 azimuth of a tungsten 110 surface are compared with the free electron volume and surface plasmon dispersion relations Author **Electron Scattering from Diatomic Molecules in the 1st Born Approximation** Jang-Wang Liu,1972 Inelastic Electron Scattering from Atoms and Molecules at Medium Energies Russell Bonham, INDIANA UNIV BLOOMINGTON., 1965 The purpose of the project was to make use of all the information that can be garnered from electron scattering from molecules to obtain detailed information about the structure of molecules The design and construction of an electron spectrometer was undertaken Various theoretical studies necessary for the proper interpretation of experimental results were also carried out Achievements include the calculation of the effect of chemical binding on gas electron diffraction patterns and the experimental observation of this effect in the molecules H2 NH3 CH4 and H2O New techniques were developed for the solution of the molecular and atomic integrals needed in the calculation of theoretical electron diffraction intensity curves for comparison with experiment Partial wave elastic scattering factor calculations were carried out for a number of atoms and new least squares and auto correlation techniques were devised for the refined analysis of electron diffraction data in order to obtain precise molecular parameters In addition the molecular structures of the compound C6C14H2 C6Br6 cycloheptatriene and perylene were carried out to test these newly developed techniques Elastic and Inelastic Electron Scattering from 9Be Jonathan Paul Glickman, 1989 **Elastic** and Inelastic Electron Scattering from 142,146,15° Nd Robert Maas,1974 **Elastic and Inelastic Electron** Scattering from 142, 146, 150 Nd Robert Maas (NIKHEF.),1974 Elastic and Inelastic Electron Scattering from 142, 146, 150 Nd Robert Maas, 197? Deep Inelastic Scattering: Dis 2006 - Proceedings Of The 14th International Workshop Masahiro Kuze, Kunihiro Nagano, Katsuo Tokushuku, 2007-01-23 These proceedings present the most up to date status of deep inelastic scattering DIS physics Topics such as structure function measurements and phenomenology quantum chromodynamics QCD studies in DIS and photoproduction spin physics and diffractive interactions are reviewed in detail with emphasis on those studies that push the test of QCD and the Standard Model to the limits of their present range of validity towards both the very high and the very low four momentum transfers in lepton proton scattering

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