



Spall Fracture

**Gennady I. Kanel, Sergey V.
Razorenov, Vladimir E. Fortov**



Spall Fracture:

Spall Fracture Tarabay Antoun, 2003-06-26 Shock induced dynamic fracture of solids is of practical importance in many areas of materials science chemical physics engineering and geophysics This book by an international roster of authors comprises a systematic account of the current state of research in the field integrating the large amount of work done in the former Soviet Union with the work done in the West Topics covered include Wave propagation experimental techniques and measurements spallation of materials of different classes metals ceramics glasses polymers constitutive models of fracture processes and computer simulations *Spall Fracture* Tarabay Antoun, Lynn Seaman, Donald R Curran, Gennady I. Kanel, Sergey V. Razorenov, Alexander V. Utkin, 2006-04-06 Shock induced dynamic fracture of solids is of practical importance in many areas of materials science chemical physics engineering and geophysics This book by an international roster of authors comprises a systematic account of the current state of research in the field integrating the large amount of work done in the former Soviet Union with the work done in the West Topics covered include Wave propagation experimental techniques and measurements spallation of materials of different classes metals ceramics glasses polymers constitutive models of fracture processes and computer simulations **Spall Fracture** Tarabay Antoun, Lynn Seaman, Donald R. Curran, 2014-01-15 **Constitutive Relation in High/Very High Strain Rates** Kozo Kawata, Jumpei Shioiri, 2013-11-11 The IUTAM Symposium on Constitutive Relation in High Very High Strain Rates CRHVHSR was held October 16 19 1995 at Seminar House Science University of Tokyo under the sponsorship of IUTAM Japan Society for the Promotion of Science The Commemorative Association for the Japan World Exposition 1970 Inoue Foundation for Science The Japan Society for Aeronautical and Space Sciences and Science University of Tokyo The proposal to hold the symposium was accepted by the General Assembly of IUTAM held in Haifa Israel in August 1992 and the scientists mentioned below were appointed by the Bureau of IUTAM to serve as members of the Scientific Committee The main object of the symposium was to make a general survey of recent developments in the research of constitutive relations in high and very high strain rates and related problems in high velocity solid mechanics and to explore further new ideas for dealing with unresolved problems of a fundamental nature as well as of practical importance The subjects covered theoretical experimental and numerical fields in the above mentioned problems in solids covering metals polymers ceramics and composites Emphasis was given to the following fields 1 Material characterization of solids in high velocity deformation experimental techniques typical data obtained by these techniques modeling and constitutive relations 2 Strain rate dependent elasto visco plastic stress waves 3 Crack initiation propagation and dynamic fracture toughness 4 Dynamic stress concentration 5 Structural dynamics in impact and constitutive relations of solids 6 **Fundamentals of Shock Wave Propagation in Solids** Lee Davison, 2008-05-07 My intent in writing this book is to present an introduction to the thermo mechanical theory required to conduct research and pursue applications of shock physics in solid materials Emphasis is on the range of moderate compression that can be

produced by high velocity impact or detonation of chemical explosives and in which elastoplastic responses are observed and simple equations of state are applicable In the interest of simplicity the presentation is restricted to plane waves producing uniaxial deformation Although applications often involve complex multidimensional deformation fields it is necessary to begin with the simpler case This is also the most important case because it is the usual setting of experimental research The presentation is also restricted to theories of material response that are simple enough to permit illustrative problems to be solved with minimal recourse to numerical analysis The discussions are set in the context of established continuum mechanical principles I have endeavored to define the quantities encountered with some care and to provide equations in several convenient forms and in a way that lends itself to easy reference Thermodynamic analysis plays an important role in continuum mechanics and I have included a presentation of aspects of this subject that are particularly relevant to shock physics The notation adopted is that conventional in expositions of modern continuum mechanics insofar as possible and variables are explained as they are encountered Those experienced in shock physics may find some of the notation unconventional

Material Properties under Intensive Dynamic Loading Mikhail V. Zhernokletov, B. L. Glushak, 2007-07-16 Understanding the physical and thermomechanical response of materials subjected to intensive dynamic loading is a challenge of great significance in engineering today This volume assumes the task of gathering both experimental and diagnostic methods in one place since not much information has been previously disseminated in the scientific literature

SPALL FRACTURE AND DYNAMIC RESPONSE OF MATERIALS., 1968 The report describes the time dependent fracture or spalling of materials as a result of dynamic response to shock wave or impulse loading From stress wave and fracture mechanics theory and assuming knowledge of the dynamic properties of the material theories are developed to predict the stress at the spall plane The cumulative energy stress rate and bond breaking models for the prediction of spall fracture are described along with the basic criteria of each model

Shock Waves W. M. Isbell, 2005 This book presents in a concise and comprehensive manner the essential techniques by which shock wave physicists probe the boundaries of material response to impulsive loads The author is a well known figure in shock wave physics having worked for over forty years with many of the outstanding researchers in the field The book acquaints readers both with modern instrumentation techniques including interferometers such as the DISAR and the VISAR and with methods that have been established by previous generations of experimentalists including acoustic measurement techniques and low to moderate strain rate machines Besides an exposition of the theoretical aspects of shock wave phenomena it contains large amounts of data on equations of state spallation thresholds shock wave attenuation from very high pressures and elastic constants Much of this information has been previously unavailable in open publications The text documents the transition from testing performed with explosives to the use of modern compressed gas guns which permit much more detailed diagnostics and controlled conditions In particular the author pioneered the use of two stage light gas guns which launch high density plates against specimens

located at the muzzle The high launch velocity of these guns produced data that represents the highest pressures obtained in the free world at that time Orbital Debris ,1992 *High-Pressure Shock Compression of Solids* J.R. Asay,M. Shahinpoor,2012-12-06 This book presents a set of basic understandings of the behavior and response of solids to propagating shock waves The propagation of shock waves in a solid body is accompanied by large compressions decompression and shear Thus the shear strength of solids and any inelastic response due to shock wave propagation is of the utmost importance Furthermore shock compression of solids is always accompanied by heating and the rise of local temperature which may be due to both compression and dissipation For many solids under a certain range of impact pressures a two wave structure arises such that the first wave called the elastic precursor travels with the speed of sound and the second wave called a plastic shock wave travels at a slower speed Shock wave loading of solids is normally accomplished by either projectile impact such as produced by guns or by explosives The shock heating and compression of solids covers a wide range of temperatures and densities For example the temperature may be as high as a few electron volts 1 eV 11 500 K for very strong shocks and the densification may be as high as four times the normal density **Shock Waves in Solid State Physics** G.I. Kanel',2019-04-30 Methods and the latest results of experimental studies of the strength properties polymorphism and metastable states of materials and substances with extremely short durations of shock wave action are presented The author provides a comprehensive and theoretical description of specific features of the dynamics of elastoplastic shock compression waves in relaxing media The presentation is preceded by a detailed description of the theoretical foundations of the method and a brief discussion of the basic methods of generating and diagnosing shock waves in solids Key Selling Features Addresses dynamic elastic plastic response spallation and shock induced phase transformation Provides a centralized presentation of topics of interest to the shock physics community Presents new data on the mechanism and basic patterns of sub microsecond polymorphic transformations and phase transitions Investigates destruction waves in shock compressed glasses Analyzes the behavior of highly hard brittle materials under shock wave loading and ways to diagnose fracture Shock Wave Science and Technology Reference Library, Vol. 3 Yasuyuki Horie,2008-09-18 This book is the second volume of Solids Volumes in the Shock Wave Science and Technology Reference Library These volumes are primarily concerned with high pressure shock waves in solid media including detonation and high velocity impact and penetration events This volume contains four articles The first two describe the reactive behavior of condensed phase explosives and the remaining two discuss the inert mechanical response of solid materials The articles are each self contained and can be read independently of each other They offer a timely reference for beginners as well as professional scientists and engineers covering the foundations and the latest progress and include burgeoning development as well as challenging unsolved problems The first chapter by S Sheild and R Engelke discusses the shock initiation and detonation phenomena of solids explosives The article is an outgrowth of two previous review articles Explosives in vol 6 of Encyclopedia of Applied Physics

VCH 1993 and Initiation and Propagation of Detonation in Condensed Phase High Explosives in High Pressure Shock Compression of Solids III Springer 1998 This article is not only an dated review but also offers a concise heuristic introduction to shock waves and condensed phase detonation The authors emphasize the point that detonation is not an uncontrollable chaotic event but that it is an orderly event that is governed by and is describable in terms of the conservation of mass momentum energy and certain material specific properties of the explosive

Fundamental Issues and Applications of Shock-Wave and High-Strain-Rate Phenomena K.P. Staudhammer, L.E. Murr, M.A. Meyers, 2001-02-08 This book contains the proceedings of EXPLOMETTM 2000 International Conference on Fundamental Issues and Applications of Shock Wave and High Strain Rate Phenomena held in Albuquerque New Mexico 2000 the fifth in the EXPLOMETTM quinquennial series which began in Albuquerque in 1980 The book is divided into five major sections with a total of 85 chapters Section I deals with materials issues in shock and high strain rates while Section II covers shock consolidation reactions and synthesis Materials aspects of ballistic and hypervelocity impact are covered in Section III followed by modeling and simulation in Section IV and a range of novel applications of shock and high strain rate phenomena in Section V Like previous conference volumes published in 1980 1985 and 1995 the current volume includes contributions from fourteen countries outside the United States As a consequence it is hoped that this book will serve as a global summary of current issues involving shock and high strain rate phenomena as well as a general reference and teaching component for specialized curricula dealing with these features in a contemporary way Over the past twenty years the EXPLOMETTM Conferences have created a family of participants who not only converse every five years but who have developed long standing interactions and professional relationships which continue to stimulate new concepts and applications particularly rooted in basic materials behavior

Proceedings of the Sixth International Symposium on Interaction of Nonnuclear Munitions with Structures, Panama City Beach, Florida, May 3-7, 1993, 1993

Dynamic Damage and Fragmentation David Edward Lambert, Crystal L. Pasillio, Benjamin Erzar, Benoit Revil-Baudard, Oana Cazacu, 2019-04-02 Engineering structures may be subjected to extreme high rate loading conditions like those associated with natural disasters earthquakes tsunamis rock falls etc or those of anthropic origin impacts fluid structure interactions shock wave transmissions etc Characterization and modeling of the mechanical behavior of materials under these environments is important in predicting the response of structures and improving designs This book gathers contributions by eminent researchers in academia and government research laboratories on the latest advances in the understanding of the dynamic process of damage cracking and fragmentation It allows the reader to develop an understanding of the key features of the dynamic mechanical behavior of brittle e g granular and cementitious heterogeneous e g energetic and ductile e g metallic materials

Strength of Metals and Alloys (ICSMA 6) R C Gifkins, 2013-10-02 Strength of Metals and Alloys ICSMA 6 Volume 1 contains the proceedings of the 6th International Conference on the Strength of Metals and Alloys held in Melbourne Australia on August 16 20 1982 The conference provided

a forum for reviewing advances that have been made with regards to the strength of metals and alloys and tackled topics ranging from cross slip and work hardening to alloy design for strength High strain and high strain rate processes are also discussed Comprised of 88 chapters this volume begins with an introduction to the fundamentals of strengthening mechanisms such as the temperature and strain rate dependence of the flow stress of fatigued niobium single crystals and the mechanism of slip transfer across high angle grain boundaries Subsequent chapters focus on the behavior of dislocations near a free surface the strength of polycrystals void damage in dual phase steels during plastic deformation and the dynamic strain aging of cast iron Shear band deformation process in metallic glasses is also examined This book will be of interest to engineers metallurgists and materials scientists

High Pressure Science And Technology - Proceedings Of The Joint Xv Airapt And Xxxiii Ehprg International Conference W Trzeciakowski,1996-07-04 This volume will contain about 40 invited papers and over 200 contributed papers covering all aspects of high pressure research in physics chemistry materials science and biology It will serve as an exhaustive review of recent achievements in these areas and of the topics of major interest The list of subjects include 1 Electronic optical and transport properties of solids 2 Phase transitions structural properties and lattice dynamics 3 Crystal growth and material synthesis 4 Organic synthesis and biological applications 5 Geophysical sciences 6 Instrumentation and metrology 7 Superhard materials 8 Ceramics and sintering 9 Food processing 10 Plasticity and hydroextrusion Contributors include N W Ashcroft USA V Blank Russia E M Cambell USA H G Drickamer USA W B Holzapfel Germany J Karpinski Switzerland H K Mao USA W J Nellis USA W Paul USA E G Ponyatovsky Russia A L Ruoff USA J S Schilling USA O Shimomura Japan I F Silvera USA B Sundquist Sweden

Wave Propagation in Materials for Modern Applications Andrey Petrin,2010-01-01 In the recent decades there has been a growing interest in micro and nanotechnology The advances in nanotechnology give rise to new applications and new types of materials with unique electromagnetic and mechanical properties This book is devoted to the modern methods in electrodynamics and acoustics which have been developed to describe wave propagation in these modern materials and nanodevices The book consists of original works of leading scientists in the field of wave propagation who produced new theoretical and experimental methods in the research field and obtained new and important results The first part of the book consists of chapters with general mathematical methods and approaches to the problem of wave propagation A special attention is attracted to the advanced numerical methods fruitfully applied in the field of wave propagation The second part of the book is devoted to the problems of wave propagation in newly developed metamaterials micro and nanostructures and porous media In this part the interested reader will find important and fundamental results on electromagnetic wave propagation in media with negative refraction index and electromagnetic imaging in devices based on the materials The third part of the book is devoted to the problems of wave propagation in elastic and piezoelectric media In the fourth part the works on the problems of wave propagation in plasma are collected The fifth sixth and seventh parts are devoted to the problems of wave propagation in

media with chemical reactions in nonlinear and disperse media respectively And finally in the eighth part of the book some experimental methods in wave propagations are considered It is necessary to emphasize that this book is not a textbook It is important that the results combined in it are taken from the desks of researchers Therefore I am sure that in this book the interested and actively working readers scientists engineers and students will find many interesting results and new ideas

Advances in Plasticity 1989 Akhtar S. Khan, Tokuda Masataka, 2016-07-29 Plasticity is now an established area of study within materials science and engineering mechanics The proceedings of the Second International Symposium on Plasticity and its Current Applications brings together papers on all current areas of research into the plastic behaviour of solids The main emphasis is on dynamic plasticity and study of deformation at crystal level but there are also papers on plasticity in particular materials such as superalloys and metal matrix composites the mechanics of damage and the applications of plastic theory in metal forming processes

Shock-Wave Phenomena and the Properties of Condensed Matter

Gennady I. Kanel, Sergey V. Razorenov, Vladimir E. Fortov, 2004-03-30 One of the main goals of investigations of shock wave phenomena in condensed matter is to develop methods for predicting effects of explosions high velocity collisions and other kinds of intense dynamic loading of materials and structures Based on the results of international research conducted over the past 30 years this book is addressed not only to experts in shock wave physics but also to interested representatives from adjacent fields of activity and to students who seek an introduction to the current issues With that goal in mind the book opens with a brief account of the theoretical background and a short description of experimental techniques The authors then progress to a systematic treatment of special topics some of which have not been fully addressed in the literature to date

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