1. Record Nr. UNINA9910831184003321

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Titolo	Fatigue crack propagation in metals and alloys [[electronic resource]] : microstructural aspects and modelling concepts / / Ulrich Krupp
Pubbl/distr/stampa	Weinheim, : Wiley-VCH Chichester, : John Wiley [distributor], 2007
ISBN	1-280-92160-9 9786610921607 3-527-61068-5 3-527-61067-7
Descrizione fisica	1 online resource (313 p.)
Disciplina	620.1617 620.166
Soggetti	Metals - Fatigue Alloys - Fatigue
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Fatigue Crack Propagation in Metals and Alloys; Foreword; Contents; Symbols and Abbreviations; 1 Introduction; 2 Basic Concepts of Metal Fatigue and Fracture in the Engineering Design Process; 2.1 Historical Overview; 2.2 Metal Fatigue, Crack Propagation and Service-Life Prediction: A Brief Introduction; 2.2.1 Fundamental Terms in Fatigue of Materials; 2.2.2 Fatigue-Life Prediction: Total-Life and Safe-Life Approach; 2.2.3 Fatigue-Life Prediction: Damage-Tolerant Approach; 2.2.4 Methods of Fatigue-Life Prediction at a Glance; 2.3 Basic Concepts of Technical Fracture Mechanics 2.3.1 The K Concept of LEFM2.3.2 Crack-Tip Plasticity: Concepts of Plastic-Zone Size; 2.3.3 Crack-Tip Plasticity: The J Integral; 3 Experimental Approaches to Crack Propagation; 3.1 Mechanical Testing; 3.1.1 Testing Systems; 3.1.2 Specimen Geometries; 3.1.3 Local Strain Measurement: The ISDG Technique; 3.2 Crack-Propagation Measurements; 3.2.1 Potential-Drop Concepts and Fracture Mechanics Experiments; 3.2.2 In Situ Observation of the Crack Length; 3.3 Methods of Microstructural Analysis and Quantitative Characterization

of Grain and Phase Boundaries
3.3.1 Analytical SEM: Topography Contrast to Study Fracture Surfaces3. 3.2 SEM Imaging by Backscattered Electrons and EBSD; 3.3.3 Evaluation of Kikuchi Patterns: Automated EBSD; 3.3.4 Orientation Analysis Using TEM and X-Ray Diffraction; 3.3.5 Mathematical and Graphical Description of Crystallographic Orientation Relationships; 3.3.6 Microstructure Characterization by TEM; 3.3.7 Further Methods to Characterize Mechanical Damage Mechanisms in Materials; 3.4 Reproducibility of Experimentally Studying the Mechanical Behavior of Materials
4 Physical Metallurgy of the Deformation Behavior of Metals and Alloys4.1 Elastic Deformation; 4.2 Plastic Deformation by Dislocation Motion; 4.3 Activation of Slip Planes in Single- and Polycrystalline Materials; 4.4 Special Features of the Cyclic Deformation of Metallic Materials; 5 Initiation of Microcracks; 5.1 Crack Initiation: Definition and Significance; 5.1.1 Influence of Notches, Surface Treatment and Residual Stresses; 5.2 Influence of Microstructual Factors on the Initiation of Fatigue Cracks; 5.2.1 Crack Initiation at the Surface: General Remarks
5.2.2 Crack Initiation at Inclusions and Pores5.2.3 Crack Initiation at Persistent Slip Bands; 5.3 Crack Initiation by Elastic Anisotropy; 5.3.1 Definition and Significance of Elastic Anisotropy; 5.3.2 Determination of Elastic Constants and Estimation of the Elastic Anisotropy; 5.3.3 FE Calculations of Elastic Anisotropy Stresses to Predict Crack Initiation Sites; 5.3.4 Analytical Calculation of Elastic Anisotropy Stresses; 5.4 Intercrystalline and Transcrystalline Crack Initiation; 5.4.1 Influence Parameters for Intercrystalline Crack Initiation
5.4.2 Crack Initiation at Elevated Temperature and Environmental Effects

Sommario/riassunto

This comprehensive overview of the whole field of fatigue and fracture of metallic materials covers both the theoretical background and some of the latest experimental techniques. It provides a summary of the complex interactions between material microstructure and cracks, classifying them with respect to the overall damage process with a focus on microstructurally short cracks and dynamic embrittlement. It furthermore introduces new concepts for the numerical treatment of fatigue microcrack propagation and their implementation in fatigue-life prediction models.This comprehensive overview of t