

Materials Selection in Mechanical Design

Sixth Edition

Metals	Density	Modulus	Strength	Fr. toughness	So. heat	T-conduction	T-expansion
Cast iron	7,100	170	390	35	480	50	12
Carbon steel	7,800	210	630	50	480	43	12
Low alloy steel	7,800	210	870	56	480	19	13
Stainless steel	7,700	200	540	88	480	160	24
Al-alloys	2,800	72	330	100	170	120	19
Cu-alloys	8,300	100	170	44	120	79	26
Mg-alloys	1,800	44	120	15	25	28	28
Pb-alloys	11,000	15	25	210	410	85	13
Ni-alloys	8,400	210	410	110	87	11	9
Ti-alloys	4,600	110	87	36	120	120	27
Zn-alloys	6,600	83	36				
Ceramics	Density	Modulus	Strength	Fr. toughness	So. heat	T-conduction	T-expansion
Alumina	3,700	370	370			37	7.2
Silicon carbide	3,200	410	305			105	4.4
W-carbide	19,000	70	430			78	6.1
Zirconia	6,100	450	450			24	11.0
Glasses	Density	Modulus	Strength	Fr. toughness	So. heat	T-conduction	T-expansion
Soda glass	2,500					1.9	9.3
Pyrex	2,200					1.2	3.6
Polymers	Density	Modulus	Strength	Fr. toughness	So. heat	T-conduction	T-expansion
ABS	1,000					0.26	95
PA	1,100					0.24	130
PE	1,000					0.42	160
PP	1,000					0.14	150
PET	1,300					0.14	120
PLA	1,300					0.14	160
PS	1,000					0.13	120
PVC	1,400					0.18	73
Epoxies	1,200					0.19	97
Phenolics	1,300					0.15	120
Polyester	1,200					0.29	130
Composites	Density	Modulus	Strength	Fr. toughness	So. heat	T-conduction	T-expansion
GFRP	1,900					0.47	17
CFRP	1,500					1.80	2

Michael F. Ashby



Materials Selection In Mechanical Design

**George E. Totten, Lin Xie, Kiyoshi
Funatani**



Materials Selection In Mechanical Design:

Materials Selection in Mechanical Design Michael F. Ashby, 2024-09-13 *Materials Selection in Mechanical Design* Sixth Edition winner of a 2018 Textbook Excellence Award Texty describes the procedures for material selection in mechanical design to ensure that the most suitable materials for a given application are identified from the full range of materials and section shapes available Recognized as the world's leading materials selection textbook users will find a unique and innovative resource for students engineers and product industrial designers Selected revisions to this new edition ensure the book will continue to meet the needs of all those whose studies or careers involve selecting the best material for the project at hand Includes new or expanded coverage of materials selection in areas such as additive manufacturing biomedical manufacturing digital manufacturing and cyber manufacturing Includes an update to the hybrid chapter which has been enhanced with expanded hybrid case Presents improved pedagogy including new worked examples throughout the text case studies homework problems and mini projects to aid in student learning Maintains its hallmark features of full color presentation with numerous Ashby materials selection charts high quality illustrations and a focus on sustainable design

Materials Selection in Mechanical Design Michael F. Ashby, 2004-12-30 Understanding materials their properties and behavior is fundamental to engineering design and a key application of materials science Written for all students of engineering materials science and design this book describes the procedures for material selection in mechanical design in order to ensure that the most suitable materials for a given application are identified from the full range of materials and section shapes available Fully revised and expanded for this third edition *Materials Selection in Mechanical Design* is recognized as one of the leading texts and provides a unique and genuinely innovative resource Features new to this edition New chapters on topics including process selection material and shape selection design of hybrid materials environmental factors and industrial design Reader friendly approach and attractive easy to use two color presentation The methods developed in the book are implemented in Granta Design's widely used CES Educational software Materials are introduced through their properties materials selection charts now available on line capture the important features of all materials allowing rapid retrieval of information and application of selection techniques Merit indices combined with charts allow optimization of the materials selection process Sources of material property data are reviewed and approaches to their use are given Material processing and its influence on the design are discussed New chapters on environmental issues industrial engineering and materials design are included as are new worked examples and exercise materials New case studies have been developed to further illustrate procedures and to add to the practical implementation of the text The new edition of the leading materials selection text Expanded and fully revised throughout with new material on key emerging topics an even more student friendly approach and attractive easy to use two color presentation

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Excellence Award Texty describes the procedures for material selection in mechanical design in order to ensure that the most suitable materials for a given application are identified from the full range of materials and section shapes available Extensively revised for this fifth edition the book is recognized as one of the leading materials selection texts providing a unique and innovative resource for students engineers and product industrial designers Winner of a 2018 Textbook Excellence Award Texty from the Textbook and Academic Authors Association Includes significant revisions to chapters on advanced materials selection methods and process selection with coverage of newer processing developments such as additive manufacturing Contains a broad scope of new material classes covered in the text with expanded data tables that include functional materials such as piezoelectric magnetostrictive magneto caloric and thermo electric materials Presents improved pedagogy such as new worked examples throughout the text and additional end of chapter exercises moved from an appendix to the relevant chapters to aid in student learning and to keep the book fresh for instructors through multiple semesters Forces for Change chapter has been re written to outline the links between materials and sustainable design

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procedures and equipment analysis of failure modes manufacturing processes and assembly techniques and applications Throughout the handbook an international roster of contributors with a broad range of experience conveys practical knowledge about materials and illustrates in detail how they are used in a wide variety of industries With more than 100 photographs of equipment and applications as well as hundreds of graphs charts and tables the Handbook of Materials Selection is a valuable reference for practicing engineers and designers procurement and data managers as well as teachers and students *Materials Selection in Mechanical Design, Third Edition* M. F. Ashby, 2005* **Materials and Design** Michael F. Ashby, Kara Johnson, 2002-12-10 Bestselling author Ashby guides readers through the process of selecting materials on the basis of their design suitability Many excellent attribute RmapsS are included which enable complex comparative information to be readily grasped Full color photos and illustrations throughout aid the understanding of concepts Computer-based Materials Selection for Mechanical Design D. Cebon, M. F. Ashby, University of Cambridge. Engineering Department, 1991 *The Principles of Materials Selection for Engineering Design* P. L. Mangonon, 1999 Introducing readers to the methodology of engineering design the book shows how materials selection comes into play during the design of a component or a structure and examines such engineering requirements as stress mode of loading corrosion and performance efficiencies of materials Readers are acquainted with the factors of costs and statutory requirements including environmental regulations and recycling and case studies are integrated throughout to illustrate the selection process **Mechanical Engineers' Handbook: Materials selection and mechanical design** Myer Kutz, 2006

Materials Selection for Natural Fiber Composites Faris M. Al-Oqla, S. M. Sapuan, 2017-06-09 Materials Selection for Natural Fiber Composites covers the use of various tools and techniques that can be applied for natural fiber composite selection to expand the sustainable design possibilities and support cleaner production requirements These techniques include the analytical hierarchy process knowledge based system Java based materials selection system artificial neural network Pugh selection method and the digital logic technique Information on related topics such as materials selection and design natural fiber composites and materials selection for composites are discussed to provide background information to the main topic Current developments in selecting the natural fiber composite material system including the natural fiber composites and their constituents fibers and polymers is the main core of the book with in detailed sections on various technical environmental and economic issues to enhance both environmental indices and the industrial sustainability theme Recent developments on the analytical hierarchy process in natural fiber composite materials selection materials selection for natural fiber composites and knowledge based system for natural fiber composite materials selection are also discussed Focuses on materials selection for natural fiber composites Covers potential tools and techniques such as analytical hierarchy process knowledge based systems Java based materials selection system artificial neural network the Pugh selection method and digital logic technique Contains contributions from leading experts in the field Materials and Process Selection for

Engineering Design Mahmoud M. Farag, 2020-12-30 Introducing a new engineering product or changing an existing model involves developing designs reaching economic decisions selecting materials choosing manufacturing processes and assessing environmental impact These activities are interdependent and should not be performed in isolation from each other This is because the materials and processes used in making a product can have a major influence on its design cost and performance in service This Fourth Edition of the best selling Materials and Process Selection for Engineering Design takes all of this into account and has been comprehensively revised to reflect the many advances in the fields of materials and manufacturing including Increasing use of additive manufacturing technology especially in biomedical aerospace and automotive applications Emphasizing the environmental impact of engineering products recycling and increasing use of biodegradable polymers and composites Analyzing further into weight reduction of products through design changes as well as material and process selection especially in manufacturing products such as electric cars Discussing new methods for solving multi criteria decision making problems including multi component material selection as well as concurrent and geometry dependent selection of materials and joining technology Increasing use of MATLAB by engineering students in solving problems This textbook features the following pedagogical tools New and updated practical case studies from industry A variety of suggested topics and background information for in class group work Ideas and background information for reflection papers so readers can think critically about the material they have read give their interpretation of the issues under discussion and the lessons learned and then propose a way forward Open book exercises and questions at the end of each chapter where readers are evaluated on how they use the material rather than how well they recall it in addition to the traditional review questions Includes a solutions manual and PowerPoint lecture materials for adopting professors Aimed at students in mechanical manufacturing and materials engineering as well as professionals in these fields this book provides the practical know how in order to choose the right materials and processes for development of new or enhanced products

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