

Tomoyuki Kakeshita *Editor*

Progress in Advanced Structural and Functional Materials Design

 Springer

Tomoyuki Kakeshita

Editor

Progress in Advanced Structural and Functional Materials Design



Springer

Editor
Tomoyuki Kakeshita
Division of Materials and Manufacturing Science
Graduate School of Engineering
Osaka University
Osaka, Japan

ISBN 978-4-431-54063-2 ISBN 978-4-431-54064-9 (eBook)
DOI 10.1007/978-4-431-54064-9
Springer Tokyo Heidelberg New York Dordrecht London

Library of Congress Control Number: 2012954004

© Springer Japan 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Contents

Part I Advanced Materials Research Project for Structural Applications

1	Advanced Materials Design with Forming	3
	Hiroshi Utsunomiya and Ryo Matsumoto	
2	Fabrication of Porous Metals with Slender Directional Pores	15
	Hideo Nakajima	
3	Modeling of Arc Welding Process	27
	Yoshinori Hirata	
4	Advanced Materials Design Using Lasers	43
	Tomokazu Sano and Akio Hirose	
5	Advanced Material Designs Using Friction Stir Welding Technique	59
	Hidetoshi Fujii	
6	Advanced Analysis of Surface Films Formed on Passive Metals and Alloys Using X-ray Photoelectron Spectroscopy	69
	Shinji Fujimoto	
7	Advanced Numerical Simulations of Micro-, Macro-, and Mega-Scale Structurization	83
	Masahito Mochizuki	
8	Advanced Analysis of Solidification by X-ray Imaging	93
	Hideyuki Yasuda and Tomoya Nagira	

Part II Advanced Materials Research Project for Combined Structural and Functional Applications	
9 Advanced Materials Design by Microstructure Control Under Magnetic Field	107
Tomoyuki Kakeshita and Takashi Fukuda	
10 Eco-Friendly Materials Recycling Processing	119
Toshihiro Tanaka and Masanori Suzuki	
11 Advanced Materials Design by Electrochemical Approach: Self-Organizing Anodization	127
Hiroaki Tsuchiya	
12 Advanced Materials Design by Irradiation of High Energy Particles	137
Takeshi Nagase	
13 Advanced Analysis and Control of Bone Microstructure Based on a Materials Scientific Study Including Microbeam X-ray Diffraction	155
Takayoshi Nakano, Takuya Ishimoto, Naoko Ikeo, and Aira Matsugaki	
14 Advanced Materials Design by Controlling Transformation Temperature Using Magnetic Field	169
Takashi Fukuda and Tomoyuki Kakeshita	
15 Advanced Materials Design for Fe-Based Shape Memory Alloys Through Structural Control	181
Hiroyuki Y. Yasuda	
Part III Advanced Materials Research Project for Functional Applications	
16 Fabrication of Photonic Crystals by Stereolithography Technique	195
Soshu Kirihara	
17 Design, Fabrication, and Properties of Nanomaterials Using Ultrathin Film Techniques	213
Yu Shiratsuchi	
18 Advanced Materials Design via Low-Damage Plasma Processes	225
Yuichi Setsuhara	
19 Advanced Analysis of Magnetic Structure in Materials	237
Tomoyuki Terai and Tomoyuki Kakeshita	

20 Advanced Materials Design by Lithography Technique 249
 Ryoichi Nakatani

**21 Advanced Materials Design of Rare-Earth-Doped
 Semiconductors by Organometallic Vapor Phase Epitaxy 261**
 Yasufumi Fujiwara, Yoshikazu Terai, and Atsushi Nishikawa

**22 Advanced Analysis of Defect Formations
 and Phase Transformations in Nanoparticles
 by In Situ Transmission Electron Microscopy 273**
 Hidehiro Yasuda

Index 283