

PERGAMON MATERIALS SERIES

SERIES EDITOR: R.W. CAHN

THERMALLY ACTIVATED  
MECHANISMS IN CRYSTAL  
PLASTICITY

by

D. CAILLARD and J.L. MARTIN



Pergamon

**PERGAMON MATERIALS SERIES**

# **Thermally Activated Mechanisms in Crystal Plasticity**

by

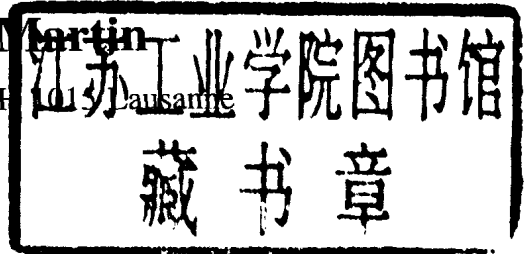
**D. Caillard**

CEMES/CNRS-BP4347, F 31055 Toulouse Cedex

**J. L. Martin**

IPMC/EPFL-CH-1015

Lausanne



**2003**



**PERGAMON**  
**An Imprint of Elsevier**

**Amsterdam – Boston – London – New York – Oxford – Paris**  
**San Diego – San Francisco – Singapore – Sydney – Tokyo**

ELSEVIER Ltd  
The Boulevard, Langford Lane  
Kidlington, Oxford OX5 1GB, UK

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First edition 2003

Library of Congress Cataloging-in-Publication Data

Caillard, Daniel.

Thermally activated mechanisms in crystal plasticity / by Daniel Caillard, Jean-Luc Martin.

p. cm. — (Pergamon materials series; 8)

Includes bibliographical references and index.

ISBN 0-08-042703-0

1. Materials at high temperatures. 2. Crystals—Plastics properties. I. Martin, Jean-Luc, 1938-II. Title. III. Series.

TA417.7H55C35 2003

620.1'1296—dc21

2003053563

British Library Cataloging in Publication Data

Caillard, Daniel

Thermally activated mechanisms in crystal plasticity. -

(Pergamon materials series ; 8)

1. Dislocations in crystals 2. Crystals - Thermal properties

3. Crystals - Plastic properties

I. Title II. Martin, Jean-Luc

548.8'42

ISBN: 0 08 042703 0

© The paper used in this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).  
Printed in The Netherlands.

## Series Preface

My editorial objective in this Series is to present to the scientific public a collection of texts that satisfies one of two criteria: the systematic presentation of a specialised but important topic within materials science or engineering that has not previously (or recently) been the subject of full-length treatment and is in rapid development: or the systematic account of a broad theme in materials science or engineering. The books are not, in general, designed as undergraduate texts, but rather are intended for use at graduate level and by established research workers. However, teaching methods are in such rapid evolution that some of the books may well find use at an earlier stage in university education.

I have long editorial experience both in covering the whole of a huge field – physical metallurgy or materials science and technology – and in arranging for specialised subsidiary topics to be presented in monographs. My intention is to apply the lessons learned in 40 years of editing to the objectives stated above. Authors (and in some instances, as here, editors) have been invited for their up-to-date expertise and also for their ability to see their subject in a wider perspective.

I am grateful to Elsevier Science Ltd., who own the Pergamon imprint, and equally to my authors and editors, for their confidence, and to Mr David Sleeman, Publishing Editor, Elsevier Science Ltd for his efforts on behalf of the Series.

Herewith, I am pleased to present to the public the eighth title in this Series, on a topic of great current concern.

ROBERT W. CAHN, FRS  
(*Cambridge University, UK*)

# Preface

The authors decided to start this joint venture, during the International Conference on the Strength of Materials (ICSMA11), in Prague, in August 1997. The idea was to gather experimental results and their physical interpretation about various dislocation mobility mechanisms. These were part of their respective lines of research, performed more or less independently through the years.

Later on, they were lucky enough to meet Professor R. W. Cahn, FRS, who became enthusiastic about the idea and very patiently encouraged them to realize their project.

The correct description of dislocation mobility mechanisms and related activation parameters, requires:

- (i) The selection of the relevant experimental facts. This is sometimes a difficult task, given the abundance of available informations at different scales and levels of resolution.
- (ii) A proper derivation of the related theory.

The reader will find a blend of data and related interpretations; we hope that the physics of the processes is not hidden by the equations.

It is a pleasure to acknowledge the helpful comments we have received from several colleagues and friends. At an early stage of the writing, Prof. F.R.N. Nabarro suggested several important points to include. All through the years repeated contacts and discussions with a variety of individuals have tremendously helped to refine our views on different subjects. In EPF-Lausanne, JLM would like to thank particularly F. Nabarro, G. Saada, and M. Kleman, who came several times as visiting scientists, F. Lévy, for his good advices, J. Bonneville for his long and active collaboration on several of the topics presented here, T. Kruml for numerous discussions and a long list of former postdocs, particularly M. Mills, K. Hemker, M. Cieslar and former PhD students among whom are M. Morris, P. Anongba, N. Baluc, P. Spätig, B. Viguier, B. Lo Piccolo (Matterstock), and C. Dupas (Charbonnier), whose articles are duly referenced. Many thanks are also due to Ms S. Lovato who has typed most of the manuscript in addition to her heavy daily tasks, and to M. O. Bettler and L. Heinen for their very careful handling of all the figures.

In CNRS Toulouse, DC is indebted to his colleagues and friends from the laboratory and from abroad, A. Couret, G. Molenat, M. Legros, F. Momprou, G. Vanderschaeve, N. Clément, V. Paidar and E. Conforto for their contributions to several of the experiments and theoretical developments presented.

Grateful acknowledgement is made to Professor G. Margaritondo, Dean of the Faculty of Basic Sciences at EPFL, for providing favorable conditions for this venture, to the Swiss

National Science Foundation, for the financial support of most of the research performed in Lausanne.

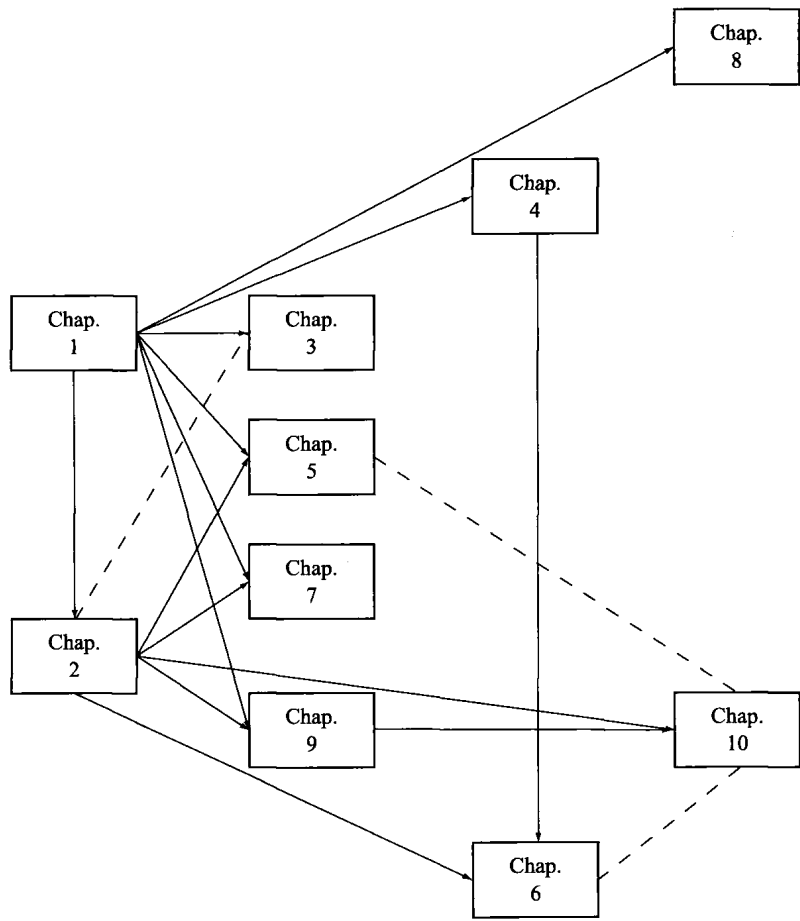
Last but not least, the authors are greatly indebted to Prof. J. Friedel who, several years ago, showed them the way.

DANIEL CAILLARD, JEAN-LUC MARTIN

December 2002

# Reader's Guide

Organization of the material: the arrows indicate a recommended reading order.



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