STRUCTURAL SCIENCE
CRYSTAL ENGINEERING
MATERIALS

ISSN: 2052-5206
journals.iucr.org/b

Intelligent Materials and Structures. By Haim Abramovich. De Gruyter, 2016, Paperback, Pp. VIII+378. Price EUR 69.95, USD 98.00, GBP 52.99. ISBN 978-3-11-033801-0

Gertjan Koster

Acta Cryst. (2017). B**73**, 1196–1197

STRUCTURAL SCIENCE
CRYSTAL ENGINEERING
MATERIALS

ISSN 2052-5206

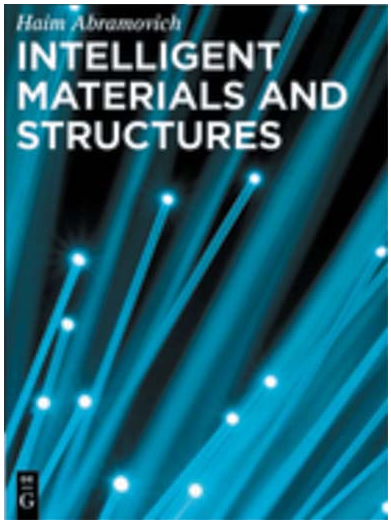
Intelligent Materials and Structures.

By Haim Abramovich. De Gruyter, 2016, Paperback, Pp. VIII+378. Price EUR 69.95, USD 98.00, GBP 52.99. ISBN 978-3-11-033801-0

Gertjan Koster*

University of Twente, Carre 3247, PO Box 217, Enschede, 7500AE, The Netherlands. *Correspondence e-mail: g.koster@utwente.nl

Keywords: book review; materials.



In his book *Intelligent Materials and Structures*, Abramovich attempts to give a complete overview of coupled effects found in materials or composites which can be used to design a system that responds intelligently to its environment. By definition this 'field' is served from different disciplines such as micro-engineering sciences, electrical engineering and materials sciences, and the author is seemingly comfortable in communicating to all. Although coupled effects could in principle comprise many different materials properties (piezo, electrical resistance *etc. etc.*) responsive to a vast range of external stimuli (electrical, mechanical, chemical *etc.*), the book is ultimately restricted to mechanical responses, such as piezoelectrical, shape memory, electrorheological and magnetorheological and electro- and magnetostrictive responses. All topics are broadly covered by a brief general description of the effect, a few examples of applications and the governing coupling constants, to an in-depth discussion of the leading phenomenological models. Sometimes, in places the reader might be overwhelmed by the amount numberof mathematical equations; however, the author has made an attempt to move some of the definitions to appendices in order to maintain readability. Figures are mostly appealing and illustrative, in particular when supporting the applications. Overall, the text seems well prepared and the general appearance is appealing.

Depending on their background, readers from micro-engineering can use the book as a thorough introduction as well as a reference text. Scientists who lay an emphasis on the application as well as development of continuum models for materials may find the book really useful. For these sections, the readers should be comfortable with tensor and vector calculus and solving partial differential equations. Researchers from the basic sciences connected to microstructure and first-principle modelling are not so well served by this book in terms of the theoretical aspects but possibly may find it a useful resource for literature on applications.

The first chapter starts with a very general introduction to the field of smart materials, positioning the topics covered in the book. Also, for the four types of materials a literature review is given, categorized by application. For those readers in need of broad access to all or some of the materials systems discussed, this chapter should be sufficient.

Subsequently, five chapters are dedicated to a detailed discussion of the previously mentioned effects, all having a more or less similar outline, from the basic applications and equations to a discussion on the models with a phenomenological basis using continuum equations. In particular, piezoelectricity is given a broad podium with discussions on details of this material class (PZT) in various mechanical configurations. If a reader is mostly interested in this particular property, he or she might be better served by a more dedicated text, *e.g.* Holterman & Groen (2013). Note that the topic of Chapter 2 lies somewhat outside the scope of the book, discussing laminated composites, but provides a nice basis for the formalisms used in the remainder of the text. The book ends with two chapters focusing on specific applications in the aerospace or medical sectors, piezoelectric motors and, in particular, that of energy harvesting. Also in these chapters, piezoelectric materials are thoroughly covered.

In conclusion, many students and researchers from micro-engineering to materials sciences may find some or all sections of the book useful; it contains many details, particularly on continuum models of mechanical properties of materials and their coupling to external stimuli. An extensive list of relevant literature is provided for both the experts and students who need to orient themselves in depth in the various fields. In particular, piezoelectric materials and their applications receive ample coverage. The book should not be considered as a college textbook.

Reference

Holterman, J. & Groen, P. (2013). *Piezoelectric Materials and Applications*. Apeldoorn: Stichting Applied Piezo.