Book review

The Science of Construction Materials

Per Freiesleben Hansen, edited by Ole Mejlhede Jensen. Springer, Heidelberg, Germany, 2009, ISBN 978-3-540-70897-1 (book) and e-ISBN: 978-3-540-70897-1, **£117.00, 329 pp.**

The late Professor Per Freiesleben Hansen (1936–2002) recognised ‘an unfortunate gap’ between specialised research scientists and engineering practice in respect of construction materials; the concept of ‘materials science’ had not bridged this gap for civil engineering. As a result, Hansen spent 10 years compiling a textbook in Danish, ‘Materialefysik for Bygningsingeniører’, which was published in 1995 by the Danish Building Research Institute. This impressive new book is an English version of Hansen’s ground-breaking work, translated and thoroughly updated by a team led by Professor Ole Mejlhede Jensen of the Technical University of Denmark, who worked closely with Hansen for 15 years.

Unambiguously, the objective of this book is to teach, or perhaps rather facilitate the learning of, the scientific principles underlying the properties, behaviour and performance of construction materials. To this end, the book is not a simple explanatory text, but instead presents a potentially, and sometimes undeniably, complicated subject in an accessible style, and also employs many innovative devices to help the reader and student. For example, each chapter first deals with a particular element of the scientific background and then concludes with a summary list of ‘the key ideas’, followed by examples of ways in which the theoretical matters explained in the chapter can be applied in practice to aspects of construction materials. Finally, each chapter concludes with a selection of carefully constructed exercises, to enable the reader to assess their understanding (the solutions are provided in Appendix C).

The core of the book is six chapters of roughly equal length (approximately 30–40 pages), each dealing with a crucial aspect of the scientific basis: substance systems; thermodynamic concepts; first law of thermodynamics (energy conservation); second law of thermodynamics (entropy); calculations of equilibrium and electrochemistry. These difficult scientific topics are presented in a creative format, with helpful diagrams and photographs (all black and white) being copiously placed in wide margins alongside the text, which in turn shows key terms in bold print and also clearly separates definitions and essential formulae within boxes (the former with a bold frame). Some may consider this format as overly fussy, but this reviewer found it assisted with the digestion of some complex explanations.

Finally, the main instruction chapters are supported by some detailed appendices, including a summary of selected physical and mathematical concepts (A, 40 pages) and useful tables of physical constants and substance data (B, 30 pages). Another three appendices contain the exercise solutions (C), an effective subject index (D) and a one-page (E) acknowledgement for illustrations.

The civil engineering profession is indebted to the late Professor Hansen for initiating this valuable textbook and also to Professor Jensen for keeping it alive and bringing it on to the world stage in this updated and English language version. Translations are not always satisfactory, but there need be no such concerns in this case; native English speakers will struggle to find fault with the elegant narrative. I have no hesitation in recommending investment in this book, which can perform its educational task in some style and then become a trusted handbook and increasingly worn source of reference over many subsequent years of service on the working bookshelf.

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