

## BOOK REVIEW

**J.W. McCauley, et al (eds), *Ceramic Armor Materials By Design (Ceramic Transactions, Volume 134)*, The American Ceramic Society, Westerville, Ohio, 2002 (ISBN 1-57498-148-X).**

**Reviewed by Paul Hazell**

*Ceramic Armor Materials by Design* is a collation of papers that were presented at the *Ceramic Armor Materials by Design Symposium* held under the auspices of the American Ceramic Society's International Conference on Advanced Ceramics and Glass, November 4–8, 2001 in Wailea, Maui Hawaii. Effectively, this book is the symposium proceedings. Each paper has been edited by a collection of eminent researchers who are involved in the study of terminal ballistics.

Because it is simply a collection of scientific papers it is certainly is not the sort of book that makes for ideal bedside reading, neither is it the sort of book that I would expect to find on many coffee tables around the world. However, if you are interested in the development of ceramic armour systems to be used in the protection of personnel, VIP vehicles, lightweight armoured fighting vehicles and heavy armour then this book should be on your office bookshelf or, at the very least, in your departmental library!

The reason the symposium and hence this publication is outlined in the preface. Essentially the aim was to enhance the current understanding of what determines the ballistic performance of a ceramic and to assess the current status of computer codes and analytical equations used to model penetration into these materials. The symposium was co-sponsored by the US Defense Advanced Research Projects Agency, the US Army Research Office and the US Army Research Laboratory and therefore it is no surprise that despite the symposium being international, quite a large proportion of the content comes from US sources. Nevertheless, this publication's usefulness is in its breadth of content and contributory sources—with authors from academia, private industry and government funded labs not only in the US but in the UK, Australia, France, Germany, Sweden, Korea, Japan, the Ukraine, Russia, and Turkey.

The book is broken down into a number of sections with each section devoted to specific subject matter within the context of ceramic armour materials research. The book begins with a section on ceramic armour development that deals with practical issues of ceramic armour design and application including two papers on the development of

“space saving” tungsten carbides. The next section has a collection of papers devoted to the study of penetration mechanisms and testing of ceramic armour systems and will prove valuable to any engineer involved in the development of lightweight armour solutions. The behaviour of some ceramics under high strain rate loading is detailed by papers in another section examining dynamic fracture, shock compression and release and dynamic indentation of ceramic materials. There is also a section on analytical and computational modelling of ceramic penetration and it contains a number of papers on the evolving field of failure prediction. Other sections of the book consist of research papers presenting results from current research in ceramic damage mechanisms during penetration, microstructural effects on ceramic armour performance, processing and manufacturing techniques and development of novel and ultra lightweight concepts. There is also a small section on the subject of the relatively small group of transparent ceramics such as aluminium oxynitride and magnesium aluminate spinel.

An attractive feature of this book is the number of overview papers that makes it a useful resource for not only the novice engineer but also the experienced terminal ballisticsian. There are also a few general papers that explore, for example, comparisons of materials or models. Another attractive feature has to be its uniqueness. To my knowledge there is not another single book that collates the work from such a vast wealth of experience on the subject ceramic armour design and I hope that this will be the first of many similar themed publications. As I write this review, the proceedings from the subsequent American Ceramic Society 105<sup>th</sup> Annual Meeting is being published (Ceramic Transactions Vol. 151).

However, one of the drawbacks of such a collection of work is the variability in the writing style and hence the readability of the work. Furthermore, it was a little disappointing to see content that had been previously published in earlier journals or symposium proceedings. The list price too leaves a lot to be desired but is line with many speciality texts at \$129 (USD)—the book can be ordered directly from the American Ceramic Society's web site.