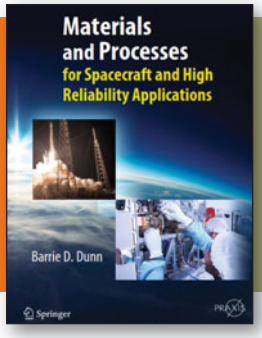


Materials and Processes for Spacecraft and High Reliability Applications

Barrie D. Dunn

Springer Praxis Books, 2016
667 pages, $229.00 (e-book $179.00)
ISBN 978-3-319-23361-1

As a materials scientist with some interest in space materials, reviewing this book was a delight. It is a follow-up to Dunn's 1997 book, *Metallurgical Assessment of Spacecraft Parts, Materials and Processes*. However, the current book updates the older one with the materials advances of the last 20 years, and is timely due to the steadily increasing number of spacecraft being launched with the increased demand for commercial telecommunication tools. Space is a punishing area in which to work, as the lightweight, robust materials must be able to withstand the shock and vibration of launch, and then remain functionally robust during exposure to cycles of excessive heat and cold while in a vacuum and exposed to the space radiation environment. Further, as Dunn notes, the materials in spacecraft can be exotic and doted upon, as the overall cost of materials in a spacecraft comprises only about 10% of the total program.

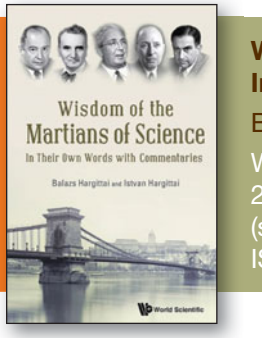
The book starts with a chapter describing the unique demands of spacecraft materials, and then is followed by a chapter on integration of materials into product assurance schemes. The latter chapter is a somber reminder to spacecraft researchers and engineers about the methodical approach that must be used to introduce new materials, and that a full team overviewing quality, reliability, and safety is needed to ensure proper functionality. From there, the book includes a chapter on how materials analysis can be used to prevent failure, and gives a top-level review of many of the materials processes that might be employed (welding, brazing, etc.), mixed with methods to control the processes and components. Another chapter discusses the metallography applied to spacecraft test failures, and another discusses electrical interconnections. The subject of whisker growth—something specific to the thermal cycles and vacuum environment endured by spacecraft—is also covered.

Corrosion prevention is another key topic, and useful advice and tables are provided regarding how to avoid joining metals of different potentials. The book concludes with a chapter on materials post-analysis, and then has 100 pages of tables on everything from linear expansion coefficients to examples of declared materials lists. The materials described are generally well known, such as standard polymers, titanium, and beryllium, as well as alloys of steel, aluminum, and copper. Graphene, which is now well researched by materials scientists, is portrayed as an emerging material for space. Dunn makes the reader appreciate how to join and use materials effectively so that they survive use on a spacecraft.

Readers should be aware that this book is primarily focused on spacecraft that would be used for commercial purposes, and includes only one sub-chapter for specifics required for manned compartments. There is neither mention of the requirements for oxygen cleaning nor the use of electrochemical fuel cells.

I strongly recommend Dunn's book as a resource for all working in spacecraft materials and assembly and other related fields. It provides a vast amount of information plus a consistent approach that would be hard to find in a web search. As emphasized throughout the book, there must be a team ready to examine all aspects of a material and how it will withstand the environment in which it will be used. Armed with Dunn's book, any materials researcher working on spacecraft will be off to a good start toward developing a reliable and high-performance vehicle.

Reviewer: Karen Swider Lyons *researches fuel-cell and battery materials and their integration into naval systems in Alexandria, Va., USA.*



Wisdom of the Martians of Science: In Their Own Words with Commentaries

Balazs Hargittai and István Hargittai

World Scientific, 2016
264 pages, $64.00
(softcover $34.00, e-book $27.00)
ISBN 978-981-4723

This is an uncommon book: It is neither a monograph nor a sum of five biographies, but rather a collection of quotations, commentaries, and ideas not only on basic and applied sciences, but also on politics, religion, life and human traits, environmental issues, and the future.

The book joins five prominent personalities (John von Neumann, Theodore von Kármán, Leo Szilard, Eugene P. Wigner, and Edward Teller) of the mid-20th century as Jewish-Hungarians in the fields of mathematics and computers, who completed higher education in Germany and as refugees emigrated from the anti-Semitic Horthy and Nazi regimes to America.

All five Martians became eminent players in fundamental sciences, but their wisdom remained open to top-level applications. For von Neumann, the

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