Where's the detail?

NANOTECHNOLOGY APPLICATIONS AND MARKETS BY LAWRENCE GASMAN

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For those who have worked in the field of nanotechnology for several decades, many of the hopes that are raised by this book — and much of the promise that is offered — will be familiar. But why is it that nanotechnology has captured so much attention and given rise to so many major funding initiatives world-wide? By the end of this book I was, sadly, none the wiser.

The author is a market analyst who specializes in nanotechnology and communications, so it will come as no surprise to technologists to discover that there are very few hard technology facts in the book. It seems that there is a big gulf in understanding between market analysts and engineers (or scientists). After an introductory overview the author defines a number of business sectors — semiconductor, computing and telecommunications; medical and pharmaceutical; and energy — and then proceeds to dissect each of these sectors to convince the reader of the huge opportunities that are going to open up in them. He also offers advice to companies on how to conduct an audit to examine the possible implications of nanotechnology on their operations. He does all of this with genuine missionary zeal but I cannot see this appealing to the technologists in the companies that are in touch with real market forces.

There is also a lot of repetition in the book, and much of the information in the tables is somewhat superficial. This is unfortunate because it is the general lack of real discrimination about nanotechnology, especially about the impacts it will have in industry and society, that is leading many to question the entire subject. This book will tend to deepen scepticism amongst true engineers but, on the other hand, it may also serve to enthuse those wishing to learn a bit more about the possible impact of nanotechnology on future products and industry. It is hard to please everyone.

A good example of poor attention to detail can be found in the section on energy. In the analysis of photovoltaic solar cells, for example, the author does not supply the basic facts and figures about the current generation of silicon-based cells, such as the cost of manufacture, the expected lifetime and the power output that can be expected under some sort of average operating conditions. The references are not very helpful either. The reader therefore finishes this chapter without knowing what is required of the next generation of photovoltaic technology in terms of breakthroughs in R&D or the provision of added value. Nor is there any discussion of the various different technologies (thin-film semiconductors, dye-activated titania and so on) that might be successful. Such omissions are disappointing because earlier in the book the author had promised to go into photovoltaics in some depth. All that is given, however, is a set of vague hopes and promises. I really hope that this is not going to be the epitaph for all of nanotechnology.

Despite many shortcomings, the book does contain various reminders and prompts that will be useful to even the most hardened technology realist. Staying with energy, there is a timely reminder that energy storage in the form of batteries is going to assume greater importance in years to come, and that the necessary advances in battery performance are likely to come from the application of nanoscience. However, the author fails to do justice to many other possible applications of nanotechnology in the energy sector. It is also rather irritating to find that familiar catalysts are being rebranded as nanocatalysts. Anyone with any knowledge of the field would know that catalysts have been nanomaterials for many decades. Again, the book would have been improved if the author had made some attempt to quantify the benefits that improved catalysts could bring.

Throughout the book we find the progression from 'micro' to 'nano' presented as though it is natural and is going to make everything better. Gasman even argues that microarrays are going to be replaced by nanoarrays for various applications in biomedical applications, without seeming to appreciate that nanotechnology is already exploited in state-of-the art microarrays. The safety issues surrounding nanomaterials are scarcely mentioned and, in common with the rest of the book, the many possible applications of nanotechnology in medicine are not covered with the level of detail they require.

I wonder what Irving Langmuir and his fellow technologists at General Electric labs in the 1930s would have made of the current hype and interest in nanotechnology. Langmuir used his understanding of chemical bonding at the atomic and molecular level to design longer-lived light bulbs, to improve the electron emission from cathodes for use in thermionic valves, and to develop ideas for preparing monomolecular layers that could be applied to reduce evaporation from water. Many of the industrial sectors that this books says are ready to be transformed by nanoscience and nanotechnology are the same now as they were back then, even though there has been enormous progress over the past 70 years. It is odd that nanomissionaries always seem to give credit to Feynman and Drexler, but never even mention the true luminaries and brilliant scientists in the field, such as Langmuir.

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