

respond to intervals of positive excursion of  $\delta^{18}\text{O}$  indicating climatic cooling and sealevel drop. The study of *Orbulina universa* for oxygen and carbon isotopic composition from sediments cores in eastern Arabian Sea for potential monsoon proxy has been discussed in detail by Ramesh and Tiwari. The paper by Saraswati discussed foraminifera–algal symbiosis and their significant implication in paleobiology and paleoceanography.

The solitary paper on calcareous nannofossils records a rich assemblage from the Neogene of Andaman Sea.

Based on distribution pattern of benthic foraminifera from Krishna–Godavari delta, Bhattacharjee and others have described several biofacies and their environmental significance with special emphasis on relict sediments.

The editing of the volume by Devesh K. Sinha is praiseworthy, particularly the layout, quality of illustrations, printing and overall getup. There are some spelling mistakes especially in the titles and text of some papers which could have been avoided.

To summarize, this book is a welcome addition to the literature on micropaleontology and is recommended for stratigraphers and micropaleontologists both in industry and academia alike.

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**The Nano-Micro Interface: Bridging the Micro and Nano Worlds.** Han-Jorg Fecht and Matthias Werner (eds). Wiley-VCH Verlag GmbH & Co. KGaA. 2005. 327 pp. Price not mentioned.

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Nanotechnology has acquired a new dimension in almost all spheres of materials technology and is influencing virtually all systems; yet microtechnology stands out on its own right. In this backdrop, the title of the book under review attracts immediate attention. The contents mainly deal with nanotechnology for electronics, but also have a few articles of other disciplines as well. The book consists of three parts. Part I which constitutes about 23% of the book is not of much use to serious researchers. In fact, it is purported to limit discussions around micro-level only but, on many occasions, it interpolated many macro/mega manage-

ment terms like venture capital, investment, partnership, marketing, etc. Part II placed under the heading 'Fundamentals and technology' constitutes about 45% of the book and Part III is placed under the heading 'Applications'. Articles under Parts II and III are generally overlapping in nature; and some of them are interesting. For example, a short write-up on 'Nanomaterials and smart medical devices' and an article entitled 'Bioinspired anti-reflective surfaces by imprinting processes' will in fact motivate many readers to learn more from nature to simulate systems through nanotechnology. Illustratively, information on the surface properties of lotus leaf in the nanoscale level enables one to understand the scope of super hydrophobic surfaces by imprinting process. The idea for creation of moth-eye surface structure to improve light transmission in large and complex surfaces evokes special interest. Besides, discussion on anti-reflective coating deserves mention, where the concept of nanotechnology has been presented with an interdisciplinary approach through chemistry, physics and engineering. In fact, these two articles should be read at the outset to appreciate the scope of nanotechnology in a broader perspective.

A short article entitled 'Biomimetic nanoscale structures on titanium', focuses on biocompatibility, highlighting the necessity of histocompatibility for strong tissues–implant interactions vis-à-vis hemocompatibility, where no such interaction between body fluids and foreign surfaces is required. Discussion on nano-crystalline oxide-reinforced polymer electrolytic membrane for fuel cell for energy generation with clean technology approach is important in the contemporary context. It also shows the application of electroencephalogram (EEG), where scalp electrodes are connected indirectly with the skin via electrolyte bridge using a special type of gel. The article on applications of diamond nabbed nano- and microtechnology shows the scope of diamond-based devices like diodes, transistors, micro-sensors and even diamond-MEMS, besides micromechanical applications through ultra-sharp diamond-cutting edges with radii of curvature less than 5 nm, for use as scalpels for eye and neurosurgery.

The paper on microwave-driven hydrothermal synthesis of oxide nanopowders for optoelectronics is useful because of its information content, but it has a few inconsistencies. In Part II, a well-written

article on the growth of nano-wires is important from the viewpoint of interconnecting conventional electronics, microsystems and nano-electronics. Nanoparticle-based chemical gas sensor for monitoring air quality is an important inclusion in this book, where the role of size of tin oxide nanoparticles on sensitivity has been discussed. Instruments like AFM and AFAM (atomic force acoustical microscopy – a new variation of the scanning probe microscopy) are covered in two separate articles, for analysis of elastic properties of a surface with resolution down to nanometre.

As nanotechnology is an interdisciplinary field, it would have been more beneficial had there been an appendix with a list of acronyms at the end, because for example, terms like FBAR have been used (p. 181) without giving the full name while discussing new approaches towards improving piezoelectric quality of ZnO resonator devices using chemo-mechanical polishing process, to enable a mobile to work around the world on different frequencies.

Mictamict is a special class of materials and a rather uncommon topic, yet it finds place in the discussion on amorphous, electrically conducting materials for transducer applications. Another article entitled 'New technology for application-specific lab-on-a-chip' showing the potentiality to integrate microtechnology to enable fusion of chemical and electronic systems in a lab chip based on micro- and nanochemistry and surface interaction is informative. However, it may not create immediate interest among general readers because of its technical complexity.

Generally, it is known that only special polymers like PVDF can provide electromechanical effect, but the last article presents uncommon information that even a general purpose polymer like polypropylene can be considered for electromechanical response, provided it is processed to an appropriately oriented micro-cellular texture to function as a dynamic sensor.

One of the articles in Part I bears a few shallow sentences and some typing mistakes, which seem to have diluted the standard.

The article on nanates and nanites (p. 32) defines nanates as systems that are associated with passive applications of nanotechnology as exemplified by a photographic film which exploits chemical reactions to generate nanoscale particles for a nanocomposite system. On the other

hand, nanites are systems that are associated with active applications of nanotechnology; for example, information is actively transferred into a particular nanoscale system or between a nanoscale system and its surroundings.

The book generally avoids mathematical expressions, thus making it more readable for those working in materials science or those with general interest in nanotechnology. The field of nanotechnology is spreading fast with burgeoning demand for documented information, and this book will thus draw attention in the market.

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**Looking into Living Things...through MRI.** R. S. Chaugule and S. S. Ranade (eds). Prism Publications, 1514 Shivpuri, Sion Trombay Road, Chembur, Mumbai 2007. 341 pp. Price: Rs 1350.

Magnetic Resonance Imaging or MRI is a technique well-known, beyond the scientific community, even to the common man because of its widespread use in hospitals. It is therefore invariably associated with imaging human anatomy and with disease detection. That the technique is extensively used in a number of other areas such as plant science, food technology and material science is not that well-known. This book serves the purpose of bridging the gap in knowledge in this regard. It is a compilation of 19 articles on the application of MRI to a variety of systems mainly related to plants and food. There are also a few articles pertaining to human imaging and

some on methodology which have been contributed by several authors from laboratories across the globe. The book also carries a foreword by the Nobel Laureate Dr Paul C. Lauterbur, inventor of MRI, who passed away recently. The articles provide interesting reading and cover topics such as study of fruits, wine grapes and wood, and measurement of quality of food items like bread, meat, ham, seafood and so on. Clinical applications include topics such as the study of pancreas, application to cancer detection and MRI of lung. There is also an interesting work reported on functional MRI of plants, which studies how water flow in the stem of the plants is affected by an external stimulus namely switching on and switching off of light near the plant.

MRI as a technique has undergone rapid development and is now able to provide detailed images with a resolution of the order of a millimetre in the case of whole-body imaging used in hospitals to a few microns in the case of laboratory mini- and micro-imaging machines. As a result, minute changes occurring deep inside the system under investigation can be easily identified. This is the basis of disease detection in human beings and quality measurements in food items. The images provide detailed information on the structure of the object under study. It is also possible to make flow measurements using MRI. Thus, the ascent of water from the roots of plants upwards through the xylem as well as the downward flow of assimilates produced by photosynthesis in the leaves through the phloem can be imaged simultaneously and studied. Another major advantage of MRI is that it is non-invasive and non-destructive. Therefore it allows viewing cross-sections of the specimen from different directions which is not possible in the case of invasive techniques. Also, repeated examination of the specimen over a period of time is possible. Thus temporal changes such as the spread of infection in fruits, fermentation of bread dough, drying processes in wood, ripening process of ham, etc. can be monitored in fine detail.

Two factors which are unfavourable for MRI for use in an assembly line are the relatively slow speed of imaging an entire object and the bulkiness of the apparatus. Applications reported in this book indicate developments that will propel the technique eventually towards such use.

In addition to imaging, localized spectroscopy called Magnetic Resonance

Spectroscopy or MRS is also a very useful technique for disease detection and its application for detection of cancer has been illustrated. Generally proton is the choice of nucleus for MRI investigations. However imaging and spectroscopic studies using other nuclei are not rare. This is illustrated in the article on the use of lithium for the study of mammalian systems. The articles also contain application of MRI to such interesting areas as developmental biology, anatomical changes during embryonic development, cell tracking, etc. The book under review clearly shows that MRI has developed into a truly multi-disciplinary science with physicists, chemists, material scientists, clinicians, biologists, botanists, bioengineers and other scientists coming together and inventing new areas of applications of MRI.

Overall, the book makes interesting reading and will be highly useful for scientists to learn the different directions in which MRI can be applied. While there is a surfeit of books on clinical applications of MRI, there is hardly any book that covers other applications. Thus, this book is both timely and appropriate.

A few words about the format and production of the book need to be mentioned. It would have been better had more attention been given to the arrangement of articles. Thus, it would help an uninitiated reader to start with an introduction to MRI. Article 12 in the book attempts to do so, but it is in the wrong place, and could have been better presented in terms of content and accuracy. Several articles seem to have been published just as submitted by the authors without bringing them to the book format. Thus, in several cases the figures and tables are at the end of the article and not at appropriate places in the text. Also, not enough care has been taken to obtain good figures with clearly legible legends. As a result, the description of the figure is left to be guessed by the reader. There are also many glaring typos which make the reading difficult. However, if one overlooks these minor difficulties, the book is a welcome addition to the useful area of application of MRI.

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